CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

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Salaries for Public Servants

BRIGHTENING the closing days of Congress, Representative UPSHAW of Georgia introduced a bill to increase Congressional salaries from $7,500 to $10,000 a year. In support of his measure he quoted no less an advocate than the late FRANKLIN K. LANE, to the effect that men in government service should be better paid. From the flowers of Mr. UPSHAW'S rhetoric we glean information to the effect that conditions have so changed since the present rate of compensation was fixed that it is now impossible for Congressmen to live properly and in a seemly fashion on less than $10,000 a year. He painted a pitiful picture of Congressmen borrowing money with which to take themselves and families back home.

We should be the last to gainsay the assertion that the cost of living has gone up; and we know from experience that Washington is an expensive city. But our meditations follow those of the late Secretary LANE even more closely than do those of Congressman UPSHAW, for the latter is thinking of Congressional salaries only, while the former was known to have had the deepest concern for the welfare of scientific and technical employees of the government, most of whom are notoriously underpaid. Our thought goes out to examiners in the Patent Office, whose lot was recently improved in some degree, and to chemists, physicists, geologists and other scientists, engineers and men of learning who worry along in the various government scientific bureaus on $1,800, $2,500 and $3,600 a year. Years of service and unusual ability may eventually carry them to the dizzy summits of affluence in civil service with a reward of $4,000 or $5,000 per annum.

It is neither unfair nor intended to be unkind to compare the qualifications and pay of these scientific servants of the government with those of its political representatives. We admit the comparison is odious, but we cannot help remembering that scientists in the government service are required to show special and extraordinary qualifications for the work they desire to do. They are tested and examined to determine their eligibility. Rules and regulations are laid down, and only through their strict observance do we permit these men of knowledge and scholarship to work for the people. And for all these requirements the remuneration is about 60 per cent honor and 40 per cent coin of the realm. Against this picture paint the corresponding qualifications and pay of Congressmen: local popularity, persuasive oratory, political regularity, a campaign fund, and a salary disproportionate to the intrinsic value of the service rendered.

All this, however, is far from proving that the pay of Congressmen should not be increased. But we should like to see it done on the basis of special qualifications for the job. Perhaps our point would be driven home with greater effect if Congressmen were engaged on a civil service basis—required to prove by test and examination that they are specially qualified for their work. Without boasting, we think we could organize an examination that would result in a marked improvement in the competence of our great law-making body. We should be inclined to ascertain the measure of intelligence of each candidate and his knowledge of public affairs, economics, finance and business. Oratory, on the other hand, we should rate very low; indeed the addiction to impassioned oratory would be regarded as a disqualification. Then when we had thus selected our Congressmen we should pay them such salaries as are now given to other civil service employees of exceptional and proved qualifications—and await the result. It is not at all certain that even under these conditions we could keep Congressional salaries from running away from those of government scientists, but we feel quite sure that in the first shock of realization there would be a tendency to increase salaries all around. If Mr. UPSHAW would give due consideration to the technical employees of the government we should have more sympathy for his proposal.

Another Boost For Lignite

RESULTS obtained during the past year by the United States Bureau of Mines in carbonization of lignite have attracted a great deal of favorable notice. Indeed, they indicate more promising opportunities for lignite briquets than have ever been prophesied before. As a natural consequence of this important development the Canadian authorities, who also have been studying this subject, are now concerning themselves directly with the methods used by the bureau.

This work now takes very definite form in an arrangement whereby the Bureau of Mines will act as consulting engineer for the Lignite Utilization Board of Canada. Under this arrangement the bureau will design an oven to be built by the Canadian investigators in connection with their plant at Bienfait, Sask. This new installation will follow closely the lines of the simple internally heated retort which was operated so successfully at Grand Forks last summer. Thus we have further evidence of the success of the co-operative agreement under which the bureau and Professor BABCOCK, of the University of North Dakota, have been working.

The new type of oven does not provide for gas or byproduct recovery. By some this may be regarded as a return to the old beehive oven principles; as a matter of fact, it is substantially that. But the oven gives results that promise to be commercially as well as

technically successful, and that is the true measure of industrial achievement. It would have been more satisfying to our technical sense of conservation of all products from raw materials if the tar, ammonia and gas, which theoretically might be evolved from lignite, could also be saved. But equipment that would recover these byproducts is far too costly both to build and to operate for greatest present-day success in lignite processing. The bureau very wisely, therefore, chooses a method that has commercial prospect of success in furnishing a smokeless domestic fuel for states otherwise far from sources of such material. It will be time enough later to add the refinements of design and operation when the basic work of the industry, manufacture of lignite briquets, can stand on its own feet financially.

Making a Fetish Of Secrecy

TOM MIDGLEY said not long ago: "When you bolt the door of your research laboratory, you're locking out more information than you're locking in." He was enunciating a principle of open-mindedness that has characterized the automobile industry and has been responsible for much of its progress. In this principle there is a lesson for many of our chemical manufacturers, particularly those affected by the German blight that surrounds a part of our industry with an air of mystery and secrecy. The war did much to improve this condition, but it did not eliminate it. Many chemical plants, making standard products by well-known processes, have closed their doors to the outside world in order to guard more carefully their precious manufacturing "secrets."

It has been our experience that it is in those plants where the German influence is most pronounced that the greatest reserve is maintained. Sometimes this is carried to a degree that is ridiculous. We recall the case of a fine chemical factory established here many years ago by some German chemists and engineers. The plant burned down recently and has just been reconstructed under the direction of the original superintendent, Herr Doktor B. When the architects drew up the plans for the new building, the superintendent insisted that all dimensions and proportions be given incorrectly in the specifications in order to make it more difficult for anyone to copy or duplicate the installation. When the equipment was ordered special scales were provided for reading all thermometers and gages, and only the superintendent had record of their real calibration. Another interesting precaution was the insistence that the aluminum kettles used in the process be painted black, so that if any of the competitors observed them during shipment, there would still be a mystery about their construction. These are but a few unimportant observations, but they are prime examples of suspicious and self-centered policies maintained by a few of our chemical manufacturers. It is perhaps significant to point out that after the chemical plant we have just mentioned was completed, serious difficulties were encountered in one of the distillation operations. Rather than call in a recognized consultant who was expert in such matters, the superintendent made an expensive trip to Germany and at a high cost purchased the information he needed from an employee of one of his foreign competitors.

But the German chemist is not the only one to worship at the shrine of secrecy. JOHN P. HARRIS makes the statement in an article in *The Cotton Oil Press* (extracts from which appear elsewhere in this issue), "that the art of edible oil refining has progressed less since its inception than any other branch of applied chemistry . . . because practically all of the manufacturers have made a great fetish of secrecy, even introducing it into their own organizations so that only the chosen few shall know of the 'wonderful secrets' by which their efficiency is obtained." He shows very clearly the industry's need for real co-operation in the free exchange of technical information and in the common effort to advance the industry by improving the quality of its products.

There is sound logic in this doctrine and the chemical engineering industries will find that removing the millstone of secrecy from about their necks is one of the surest and quickest steps toward technical and scientific progress.

How They Do It In England

PLENTY of criticism has been directed at the National Research Council. Many times we have been tempted to join the chorus of disapproval. An organization that is all overhead, that has funds with which to "start" and "co-ordinate" researches (some derivative of the word *liaison* should be used here, despite early acquaintance with the nasty word in the novels of DAUDET and BALZAC), but which has no money to prosecute investigations—such an organization is sure to be an easy butt of ridicule.

Undoubtedly it would be more desirable to describe a better method. So at the risk of being suspected by the Hearst publications of being pro-British, we should like to call attention to the activities of their Government Department for Scientific and Industrial Research. This was formed to organize and foster industrial research. As a matter of fact, this department controls the activities of the National Physical Laboratory—corresponding somewhat to our Bureau of Standards—but in addition it has done one thing since the great war. During those red years, science was found to be of value not only to the government but to industry as well. Particularly has the awakening occurred in the metallurgical industry in its many branches—steel making, iron founding, non-ferrous alloying, rolling mills and heat-treating shops. So this national organization has brought together the firms in various branches of industry into several research associations, which are charged with the duty of fostering, organizing and *paying for* researches into practical matters affecting the industry. For instance, nearly all the big and little firms making brass and bronze have joined the Non-Ferrous Metals Research Association. Financial support is apportioned according to the size or output of the member, and the government matches the expenditures for research, pound for pound, for 5 years. Ten different investigations into common troubles are now under way. Each of the studies is costing up to £2,000 per year and they are prosecuted at various laboratories fitted to carry them on. Others of them, such as the cause of red stains in brass, are being done at the National Physical Laboratory.

Another active organization in the metallurgical trades is the British Cast Iron Research Association.

It has a membership of 202 foundries and has the good fortune of obtaining PERCY LONGMUIR as director of research. It has eight investigations actively under way, on such things as the grading of pig iron, molding sand, cylinder casting, corrosion-resisting irons, ladle linings, "draws and shrinks" in castings, and sulphur holes and hard spots.

Publication of the results of these investigations will eventually be made, although they will be divulged only to the members of the association for a specified time. However, the members are kept in touch with the progress in a unique and intimate manner: Lectures are arranged at various centers by the research staff and to which only members of the association are admitted. A full account of the investigation is then given, and demonstrations are made of recommended practice as developed by the research. Two objects are served in this manner: First, early confidential communication of the results of the research is assured to those who have given it financial support; and second, the investigator gets into close and immediate contact with that section of the industry chiefly interested in his work.

Joint activities of this sort are particularly fine because of the support by industry. Since the industries are helping to pay for the work, they are much more anxious to see the results and to make an attempt to profit thereby. Researches done by outsiders, and published, may be read, but inertia is so great that obvious applications toward individual works-practice may be, and too often are, long delayed.

Such accomplishments by our English cousins appear to be a particularly fine example of how to get a thing done. While the work is sponsored by a governmental department, there is no more compulsion on the part of industry to co-operate than there is in this country. The essential difference is that over there a fund is available to match, pound for pound, the contributions of industry, and the National Research Council would undoubtedly do well to compare the net results.

The Mystic Quest In Science

ON THE 19th of February it was 450 years since NICHOLAS KOPPERNIGK, known as COPERNICUS, was born at Thorn, in Poland of those days and later of Prussia. His uncle was a bishop. He studied law at the University of Cracow, astronomy (and canon law) at Bologna, and medicine at Ferrara. He was his uncle's private physician until the bishop's death in 1512, and then became canon of Frauenberg, after which (according to Dr. C. G. ABBOT in *Science* of Feb. 16) he exerted himself for many years as physician to the poor. His great work "De revolutionibus orbium cœlestium" was completed in 1530, but was not published until 1543, when the first printed copy was brought to the author on his death bed. The year 1543 was only 360 years ago. Let us bear this fact in mind for a few minutes.

The work to which we have referred contained the amazing, surprising, absurd and preposterous proposal that the earth is round like a ball and revolves about the sun! Now everybody knew that the earth was flat like a cake, that it was stationary, and that while a complex system of epicycles had been spun out by the learned to account for the peculiar motions of the planets, all the stars were in fact "lesser lights" and of little more importance than so many tallow dips. There was a plane above the earth and the stars—which was heaven—and another plane below the earth—which was hell. The sun was a big lantern which was raised every morning in the East, and in the evening was let down in the West. Anybody who wasn't insane and possessed of devils or in league with SATAN from choice (or by foreordination) could recognize these facts as facts. So this last and great work which followed a previous extensive treatise on monetary reform by the same author was kindly provided with a preface by his friend OSIANDER, who explained that the whole notion—observations, computations and all—was purely speculative. And it was probably well for COPERNICUS that he passed away in 1543 and not later. He had a proper funeral at all events.

His conclusions were supported by GALILEO, who was not born until 21 years after the death of COPERNICUS, and GALILEO, as we know, had his troubles for his thoughts. He was forced to deny any such foolishness on pain of torture. Not long before he died, in 1642, it is said that he ventured to say that the earth does move after all. But it was heretical to do so, and everybody knew he was wrong. That was 281 years ago.

Only 281 years ago, and this country was already beginning to be settled. Our Fourth of July dates from less than a century later. Now ideas have inertia, and continue to endure even when the reason for them is removed, just as we learn in our books on physics of the movement of material bodies. In economics they call such persistence the "drag." Nearly all our philosophy of life and our dogmas of ethics and religion and our institution of common law date much farther back than 1642. The Holy Inquisition has passed out, but its principles and habits of thought remain. The earnest pleading of ex-Secretary BRYAN against the theory of evolution is an instance of this drag of ideas.

Many persons acknowledge the vastness and immensities of space, but they continue to order their thoughts according to the Ptolemaic system, which we have theoretically abandoned, with its conclusions that spring from a belief in a little, measurable, domestic universe of which the earth is at once the nucleus and the principal substance. It is confusing to think of hundreds of thousands of light-years in connection with space while remaining sound in traditional doctrine. In fact, the world is very much bewildered in these days. Many of us don't know what to believe, and finally we settle the matter by believing in nothing but what we can see or hear. But we can see and hear so very little that it is not enough to give us a grip on life; to give us faith. Then from many of us comes a general denial and we let things go at that. This is the philosophy that GOETHE attributed to *Mephistopheles*, and he pointed to it as the road to destruction.

So the question arises whether the time is not approaching to order our thinking according to the newer and greater light of science and to venture into the field of metaphysics in the quest of faith and understanding. When ASTON computed the resolution of the fractional mass of the hydrogen atom into energy on the creation or organization of helium, did he not do this very thing? He surely sought the greater understanding. And out of the greater understanding there may emerge the greater faith. Is it not right and proper that men of science should seek it? We are in sore need of it.

Readers' Views and Comments

Marketing Of Ideas

To the Editor of Chemical & Metallurgical Engineering

SIR:—The business executive was speaking and he was talking about a subject you have frequently discussed in your columns. It was of his technical men and of their difficulties in selling themselves and their ideas that he was speaking. But, you ask, who is this executive? All that I can tell you is that he is vice-president and general manager of a large organization operating a string of plants extending from Chicago west to San Francisco. He is what is termed a self-made man; his formal education had been completed in the elementary grade school. Initiative, hard work and persistence had brought him to the top. The rungs on the ladder had not been forgotten. His old associates pointed with pride to his accomplishments and respected and admired him.

"Frequently," said he, "the technical man wonders why he does not attract a larger salary. He wonders why, when so many plans and products are brought to him for an opinion, and often this is the determining opinion of their worth or feasibility—why, when he seems such an important cog in the machinery of his organization, he should draw a salary of such modest proportions. It so happens that business pays its greatest dividends to him who risks the most, and since these dividends are in the medium of exchange, this means who risks the most money. To the initiator of an idea goes the long reward, provided he knows how to carry it to a successful conclusion, or, as is more often the case, knows how to attract men to him who know the details upon which the success of the enterprise is dependent. Speaking for our own organization and from my experience with other similar organizations I should say that the technical man is seldom the initiator of the type of idea which is possible of successful commercial application. Usually our technical men act in the capacity of consultants to whom a proposition is submitted after it seems commercially feasible. The scope of their work is necessarily limited as compared with that of some of our executives.

"Compare for a moment my work with that of Dr. ——, head of our technical department. As in any organization, the worth of a man to us can be determined by a glance at his salary check. Why is mine greater than his? Simply because I am worth more; I can bring to this organization business on which we show a profit and because all of his duties are only one part of mine. To me is assigned the task of initiating projects and pushing them to a point where they become financially profitable; to him falls the duty of helping me with the technical details of these projects. I am not the only source of energy or ideas in this organization; if I were, it would not deserve that name.

"Sometimes ideas come from the technical department which are possible of profitable application, but, and note this, our technical men, who, by the way, are as able and wide awake as any, can carry these ideas only through the laboratory and to the plant. They can bring them to the point where large-scale production is possible, but there they stop. To someone else then must go the finishing of the job. Developing a process is an important thing, but so managing production and sales of the article produced that it will return a profit to those who have risked money in its manufacture is vastly more important, and incidentally more profitable.

"Take this message back to your technical friends who are dissatisfied with their money-earning capacity. Until they are able to plan a venture, supervise its details and bring it to a point where its returns will more than earn the rental of money invested in it—until that time must they remain relatively unimportant cogs in the machine, responsible for only a part of its operation."

And thinking about this on the way home, what "Sid" said in the *American Magazine* some time ago came back to me with a new force. "How many payrolls are you on?" he asked. "How much did you draw in your *pay* envelope last month, and how much in your *satisfaction* envelope?" I wonder how many of us have answered these questions before we voiced our complaints about the meagerness of our pay envelope and the lack of appreciation of our efforts by business?

ADOLPHUS.

Production of Sodium Sulphide

To the Editor of Chemical & Metallurgical Engineering

SIR:—I have read with interest the articles on Sodium Sulphide which you have published in three recent issues of your journal and note the difficulties encountered by some.

For the manufacture of fused product I have never found any better installation that the reverberatory furnace, and even here the upkeep is very high on account of the action on the lining. However, where one wishes the 30 per cent crystals, I have had excellent results on a manufacturing scale from the batch rotary and the continuous rotary.

Some years ago I carried out experiments on a batch rotary for a chemical company in the South and obtained a reduction of 96 per cent of the theory using a charge of 1,600 lb. of coal to 2,000 lb. of salt cake and maintained my temperature between 750 and 850 deg. C. Much better and more economical results were obtained from a continuous rotary furnace using a charge of 2,000 lb. salt cake, 600 lb. of coal and 1,000 lb. of coke or residue from the leaching vats, maintaining same temperature as stated above. This gave 96 per cent of the theory, and one remarkable thing about it was it required no outside heat after it was once started. Due to the coke in the smelt it also obviates the filtration troubles. The sodium sulphide crystallized from the leachings of this material and dried and slightly washed in a centrifugal is practically chemically pure.

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How Does Idleness Affect Profits And Selling Prices?

The Executive's Problem of So Adjusting Prices as to Increase Sales and Total Profits When a Plant Is Not Operating at Capacity Involves Considerable Computation—A Simple Method of Solving the Problem Is Described in This Article

By F. P. Mullaney
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In normal times many articles are written telling how to increase profits. In dull times the question of how to reduce losses is given considerable attention. At present business has reached the point where it cannot be considered either normal or dull. While all indications point to a slow but consistent increase in the demand for manufactured products rather than a tendency to revert to a demand so small that business is considered "dull," still very few industries are running full capacity. This means that there is a certain amount of idle equipment in nearly every line of industry, which, of course, results in a loss of money.

The problem confronting the business executive today is how to increase the demand for his product so that the factory can be run at a greater capacity. While the demand for a product of a factory can usually be stimulated by a reduction in selling price, an executive cannot consider taking this step unless he has a very complete picture of the effect that a reduced selling price will have on the final profit of the business. The first question he must decide is, "Will a reduction in selling price increase the demand for the product?" The next question is of the following nature: "How much can the selling price be reduced, if doing so will increase the demand for the product and still enable the company to make the same net profit?" A selling price slightly greater than this will result in an increase to profits, although the price finally set may still be considerably lower than the present selling price. All of this assumes that the reduction in price will actually increase the volume of sales.

It is the purpose of this article to discuss, first, the relation which plant capacity has on final profits, and then present a chart for the convenient ready solution of the problems involving this relationship.

Every manufacturing plant has a certain definite expense which is incurred regardless of the amount produced. This expense consists of rent of buildings, interest, taxes, insurance, maintenance, depreciation and other fixed charges, and is generally known as "Constant Expense." If the factory is running at its full, or normal, capacity, the constant expense per unit produced is relatively small. However, if the factory is running at only a fraction of its capacity, say one-half, and turning out only one-half of its normal production, the amount of constant expense incurred per unit produced is twice as great as the desired minimum.

Some accounting systems charge the constant expense, no matter how large, against the amount produced, no matter how small. Under such a system the loss incurred shows up as an increase in the cost of production. It is becoming generally recognized that the cost of each unit of product should include only those expenses which contributed to its production and that, therefore, the constant expense should be spread over the normal capacity of the shop. Under this method, the amount of constant expense charged against the output of the factory bears the same ratio to the total constant expense as the amount produced bears to the normal capacity of the factory. Any portion of the constant expense which is not charged to the product, due to the fact that the factory has not been run at full capacity, is charged as a loss against the business. Thus, in a plant running one-half capacity and turning out one-half of its normal production, one-half of the constant expense represents the loss incurred—in other words, the cost of idleness. Of course, the cost of idleness decreases as the used capacity of the shop increases.

Entirely regardless of the accounting method used, the fact remains that, all other factors remaining the same, an increase in the volume produced and sold will not only increase the total income of the business, but will at the same time increase the profit per unit produced. This is because the fixed charges, or "Constant Expense," are less per unit produced. To indicate the similarity between both methods of charging constant expense, let us take a plant the full normal capacity of which is 200 units, but which is using only 50 per cent of its capacity and turning out 100 units. At full capacity the cost is, say, $100, of which $15 represents the fixed charges or constant expense. The accounting methods compare as follows:

	Constant Expense Distributed Over Amount Produced	Normal Capacity
Quantity produced	100	100
Per cent of capacity used	50	50
Unit cost	$115	$100
Unit selling price (est.)	$150	$150
Unit profit	$35	$50
Total profit	$3,500	$5,000
Loss due to idleness	...	$1,500
Profit after idleness	$3,500	$3,500

In order to study the relation among capacity, selling price and profit, it is only necessary to determine the loss incurred as a result of running the plant at the various rates of capacity less than normal. It is not necessary to change the accounting method, providing the present method indicates the amount of this loss.

Let us take as an example a factory running at 40 per cent capacity. In this case 60 per cent of the constant expense is the cost of idleness. If enough work can be secured to run at 70 per cent capacity, this loss

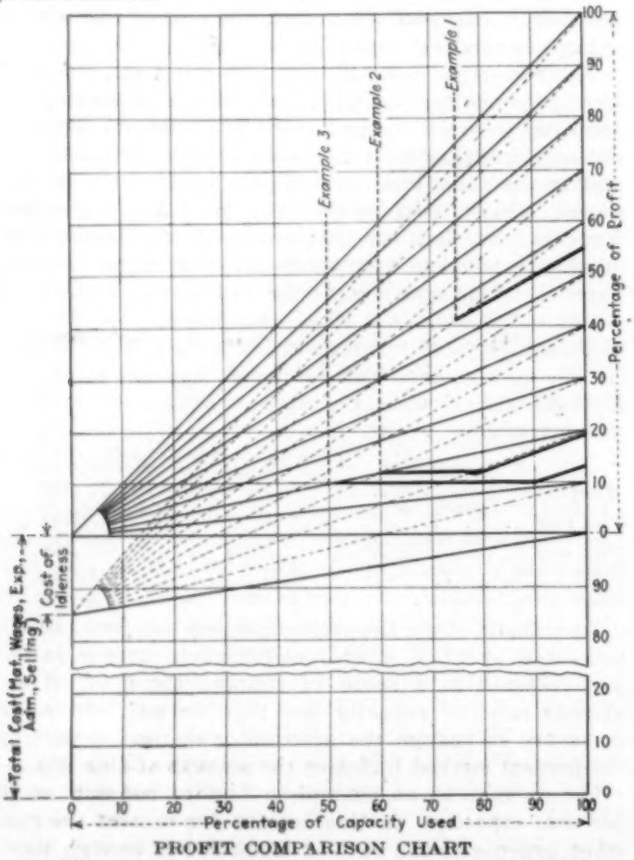
will be reduced to 30 per cent of the constant expense. Therefore, because of the reduction in the cost of idleness, the selling price can be reduced an amount equal to 30 per cent of the constant expense and the business will still make as much profit as was made previously.

The Profit Comparison Chart

The "Profit Comparison Chart" has been devised to answer the following questions:

1. With a given percentage of capacity used, and a given percentage of profit, what will be the percentage of profit after idleness has been deducted?
2. With a given percentage of capacity used and a given percentage of profit, what will be the percentage of profit for the other rates of capacity used?
3. How much can the selling price be reduced, if doing so will enable us to increase the amount of capacity used and still result in the same profit we are now making?

The chart herewith has been drawn to cover a product for which the plant has a normal capacity of 200 units, produced at a total cost of $20,000, of which $3,000, or 15 per cent, is constant expense. At zero production, $17,000 of the cost of operating at full capacity, or $85 per unit, is eliminated—the other $3,000, or $15 per unit, becomes the cost of idleness. Therefore at zero production the space below the point representing 85 per cent on the chart represents the expense eliminated, and the space above the same point and below the 100 per cent cost line represents the expense incurred, or the cost of idleness. As every unit produced decreases the cost of idleness $15, a diagonal line drawn from 85 per cent cost at zero production to 100 per cent cost at 100 per cent production will show the decrease in the cost of idleness as the capacity used increases. The scale above the 100 per cent cost line represents the various percentages of profit realized.



PROFIT COMPARISON CHART

Solid lines: profit after deducting cost of idleness. Dotted lines: profit before cost of idleness is deducted.

Lines drawn from the point representing 85 per cent cost at zero production to the points representing the various percentages of profit will show the percentage of profit before deducting the loss due to idleness. Lines drawn from the point representing 100 per cent cost at zero production to the points representing the various percentages of profit will show the percentage of profit after the cost of idleness has been deducted. On this chart dotted lines denote the profit before deduction is made for the loss due to idleness. The solid lines denote the profit after this deduction has been made.

How to Use the Chart

Through the use of a "Profit Comparison Chart" the profit before idleness at any capacity can be converted to terms of profit after idleness without the necessity of detailed figuring. Profit after idleness can likewise be converted to terms of profit after idleness. For example: 60 per cent profit before idleness at 75 per cent capacity is equivalent to 55 per cent profit after idleness. (See example 1.) The result, 55 per cent, is obtained by scaling from the zero point of the solid lines, through the point representing 60 per cent profit and 75 per cent capacity on the dotted line, to the "Percentage of Profit" scale at the right of the chart.

Knowing the profit now made at a certain capacity, it is a simple matter to determine the percentage of profit necessary, at any other capacity, to make the same amount of profit. For example: If a factory is running at 60 per cent capacity and making a profit of 30 per cent before idleness, the same amount of money can be made and the product sold at a price equivalent to a 19 per cent profit before idleness, providing enough work is obtained to run at 80 per cent capacity. (See example 2.) This is determined by scaling from the zero point of the dotted lines, through the point representing the same "Percentage of Profit" at 80 per cent capacity as at 60 per cent capacity and 30 per cent profit before idleness, to the "Percentage of Profit" scale at the right of the chart.

Example 3 shows that if we are now running 50 per cent capacity and making a profit of 20 per cent after idleness, we can make as much profit by selling at 12.8 per cent profit before idleness providing we run at 90 per cent capacity. This is determined by scaling from zero point of the dotted lines, through the point representing the same "Percentage of Profit" at 90 per cent capacity as at 50 per cent capacity and 20 per cent profit after idleness, to the "Percentage of Profit" scale at the right of the chart.

Changes in Selling Price in Different Types of Organization

Manufacturing plants may be divided into two classes. The first class embraces those turning out a more or less standard product. By this we mean articles which are regularly catalogued and sold through various representatives. The selling price on the products of factories in this class cannot be changed with any great frequency, but the "Profit Comparison Chart" will be of value whenever the question of selling price is brought up. However, it should be borne in mind that the main object of the chart is to enable the executive to tell at a glance what effect increased sales will have on profit; or, in other words, to determine readily how much the selling price of a product can be reduced, without loss of income, by increasing the amount of plant capacity used. If the selling price is reduced and

enough goods are not sold to run the plant at the capacity expected, less profit will be made. Therefore the executive who uses these charts should be reasonably certain that a price reduction will accomplish the desired results before he takes definite action.

The second class embraces plants turning out articles on job or contract work. Factories of this class obtain work on estimates made on the different jobs after taking business conditions, the amount of work ahead of the shop, etc., into consideration. The executives of these plants will find the chart of great value because, knowing the shop capacity they are now using and the gross or net profits now made, they can readily determine how low they can bid on any job and still obtain the same or better results.

Petroleum Refining Gains 335.8 Per Cent in 7 Years

Output of Marketable Products in 1922 Valued at One and Three-Quarter Billions of Dollars

ACCORDING to reports made to the Bureau of the Census, the value of products of establishments engaged primarily in refining petroleum amounted to $1,727,440,200 in 1921, as compared with $1,632,532,800 in 1919 and $396,361,400 in 1914, an increase of 5.8 per cent from 1919 to 1921, but an increase of 335.8 per cent for the 7-year period 1914 to 1921. The number of refineries has steadily increased from 76 in 1914 to 320 in 1919 and 336 in 1921. Of those reported for 1921, 67 were located in Oklahoma, 64 in Texas, 53 in Pennsylvania, 45 in California, 23 in Kansas, 16 in Louisiana, 13 each in Illinois, Ohio and Wyoming, 9 in New Jersey, 6 each in Kentucky and New York, 5 each in Indiana, Missouri and West Virginia, 4 each in Colorado and Maryland, 3 each in Arkansas and Massachusetts, 2 in Rhode Island and 1 each in Delaware, Georgia, Minnesota, Montana, South Carolina, Utah and Virginia.

Wage Earners and Hours Employed

In January, the month of maximum employment, 72,298 wage earners were reported; and in September, the month of minimum employment, 56,632; the minimum representing 78.3 per cent of the maximum. The average number of wage earners employed during the year was 63,197, as compared with 58,889 in 1919 and 25,366 in 1914. A classification of the wage earners with reference to the prevailing hours of labor in establishments in which employed shows that for 6,186, or 9.8 per cent of the total (average) number, the hours were less than 48 per week; for 27,471, or 43.5 per cent, they were 48; for 3,808, or 6 per cent, the hours were between 48 and 54; for 890, or 1.4 per cent, they were 54; for 23,294, or 36.9 per cent, they were between 54 and 60; and for 1,548, or 2.4 per cent, they were 60 or over.

The statistics for 1921, 1919 and 1914 are summarized in Table I; the figures for 1921 are preliminary and subject to such change and correction as may be found necessary from a further examination of the original reports.

Detailed statistics of production for the years 1921, 1919 and 1914 are given in Table II. While the production in the group "naphthas and lighter products" increased 27.8 per cent in quantity, and 15.1 per cent in value since 1919, the increase in the output of gasoline alone was 39.7 per cent in quantity, and 23.7 per cent in value.

TABLE I—STATISTICAL SUMMARY OF PETROLEUM REFINING, 1914-1921

	1921*	1919*	1914
Number of establishments	366	320	176
Persons engaged	74,291	73,473	31,077
Proprietors and firm members	55	59	52
Salaried employees†	11,039	14,525	5,659
Wage earners (average number)	63,197	58,889	25,366
Salaries and wages	$129,262,700	$116,368,700	$27,289,900
Salaries	27,940,300	26,619,000	7,892,400
Wages	101,322,400	89,749,700	19,397,500
Contract work	4,832,000	2,352,000	502,700
Cost of materials	1,382,425,000	1,247,908,400	325,264,500
Value of products	1,727,440,200	1,632,532,800	396,361,400
Value added by manufacture‡	345,014,800	384,624,400	71,096,900

* Figures for 1921 do not include establishments reporting products under $5,000 in value, thus excluding 7 establishments which employed 7 wage earners, and in the aggregate reported products to the value of $22,752. The figures for 1919, however, include 4 such establishments, which employed 2 wage earners, and reported products to the value of $10,996.

† Includes to some extent employees of sales and distributing departments.

‡ Value of products less cost of materials.

TABLE II—DETAILED STATISTICS OF PETROLEUM PRODUCTION, 1914-1921

	1921	1919	1914
Total value of products	$1,727,440,200	$1,632,532,800	$396,361,400
Naphthas and lighter products			
Gasoline—			
Gal.	5,098,056,700	3,648,590,600	1,195,412,100
Value	$840,672,300	$679,867,100	$106,140,200
Average value, gal.	$0.164	$0.186	$0.088
Naphtha, benzine, etc.—			
Gal.	275,176,200	557,036,200	264,626,100
Value	$40,729,400	$86,139,000	$15,779,100
Average value, gal.	$0.148	$0.155	$0.06
Illuminating oils—			
Gal.	1,963,826,600	2,305,489,700	1,935,274,800
Value	$152,515,900	$235,663,100	$96,806,500
Average value, gal.	$0.078	$0.102	$0.05
Fuel oils—			
Distillates—			
Gal.	1,220,247,000	646,652,600	457,491,600
Value	$59,586,100	$36,548,100	$15,999,400
Average value, gal.	$0.049	$0.056	$0.035
Gas oils—			
Gal.	1,634,342,200	1,393,623,500	755,558,400
Value	$85,322,400	$76,383,400	$22,805,300
Average value, gal.	$0.052	$0.054	$0.03
Residual fuel oil—			
Gal.	6,894,534,300	5,727,624,500	2,521,042,000
Value	$232,355,700	$205,192,800	$45,213,200
Average value, gal.	$0.033	$0.035	$0.087
Lubricating oils—			
Gal.	949,246,700	821,580,400	517,838,800
Value	$194,609,300	$196,242,400	$55,812,100
Greases—			
Gal.	24,440,000	28,147,500	14,006,400
Value	$9,754,800	$11,896,700	$3,536,500
Liquid asphaltic road oils—			
Gal.	168,378,000	98,036,500	(*)
Value	$7,831,200	$4,491,400	(*)
Average value, gal.	$0.046	$0.046	
All other products, value	$104,063,100	$100,108,800	$34,269,100

*Figures not available.

University of Minnesota to Have Experimental Blast Furnace

At the North Central Station of the Bureau of Mines, in Minneapolis, plans for the proposed experimental blast furnace for the University of Minnesota have been made. For the purpose of gaining assistance in the design of this experimental furnace, a careful study has been undertaken of the records obtained in 34 experimental runs on small-scale blast furnaces operated by the Bureau of Mines at Minneapolis since 1919. These records will also be studied in considering changes in the bosh and hearth of the furnace stack, now erected outside the Minnesota School of Mines building, which it is expected will be put into blast about the first of May. Several years ago a method of studying the lines of flow of stock in the blast furnace by the use of cardboard models filled with lead shot was developed. This device has also been used in testing the flow of stock in the experimental blast furnace proposed for the university.

Closure for Acid Carboys

A Review of the Report of the Committee Appointed by the Manufacturing Chemists Association

BEGINNING in May, 1920, shortly after the committee was asked to undertake the work and continuing throughout 30 months of active work, the carboy test sub-committee of the executive committee of the Manufacturing Chemists Association has completed a very valuable piece of work. The need for a study of carboy closure was great. Not only was there great unreliability in the average acid carboy closure but there was considerable danger in the use of cement and plaster of paris and other special closure agents from cracking and breaking the carboy lip. No satisfactory stopper or gasket was at hand, and considering the fact that thousands of carboys are used and shipped daily, the necessity of solving the problem was at once imperative and obvious.

The logical development of the work is intensely interesting and it is a pleasure to follow the systematic, ingenious and painstaking study involved. Starting with the three following statements of which the committee was reasonably sure, an investigation of stoppers, gaskets and stopper fastenings was begun:

1. Ground glass closures were entirely satisfactory if fastened in by any reasonably secure method.
2. Carboys with chipped necks should never be allowed for nitric acid.
3. Carboys with necks chipped as much as ¼ in. deep should be condemned.

The Ideal Closure

It will be impossible to discuss in detail the progress which was made. It is illuminating, however, to record the seven characteristics which the committee felt were desirable for an ultimately satisfactory solution to the closure problem:

(*a*) The closure must be vented in some way to prevent accumulation of pressure.

(*b*) The neck of the carboy must be sufficiently smooth to afford a proper seat for a gasket or else the gasket must be so made that it will fill all cracks and crevices.

(*c*) The stopper must be tough, well formed and uniform and must fit closely in the neck of the carboy.

(*d*) The gasket must be such as to afford a tight closure, must not be subject to disintegration through action of various acids, must not become solid so as to hinder removal, and must not discolor the acid through contact.

(*e*) The fastenings must be strong and secure and only slightly, if at all, affected by acid fumes. It must also be easily applied and removed.

(*f*) The entire closure should, if possible, be arranged so that an examination of it in place will show whether it is in good condition.

(*g*) The cost of the parts of the closure and of the labor of applying it must be reasonable.

Prevalent Type of Closure Prior to the Investigation

There were two closures in very general use before the investigation was undertaken. The committee collected considerable data on the specific criticisms of them.

Class I. The glass or earthenware stopper with a gasket, generally paraffined asbestos, held in place by a wire fastening of the "Brainerd" type or of the lever type such as the well-known "Gem" fastener. In this closure the glass stopper is easily broken; the earthenware stopper is frequently poorly designed and made and is sometimes brittle; no efficient venting is easily and surely obtained without the probability of leakage; the paraffined asbestos gasket or, in fact, any gasket of that type is efficient only when it has a nearly perfect seat; the wires of the fastener are frequently too light; and, if the carboy has a chipped neck, an additional coating of plaster of paris or some cement mixture must be applied, but such a coating has generally been found to be inefficient against handling or storage.

Class II. The earthenware (or occasionally glass) stopper sealed in place by means of plaster of paris or similar cement mixture, or possibly clay, applied between the flange of the stopper and the neck of the carboy and also coated over the entire stopper and top of the neck of the carboy and then inclosed in a burlap covering securely tied around the neck of the carboy; sometimes the burlap is further coated with tar or asphaltum. This closure is reasonably efficient when properly made and applied, but is especially undesirable because of the probability of the use of a poor cement mixture and careless application; it is also very liable to deteriorate in storage due to the cement becoming crumbly; the burlap covering frequently conceals the defects until too late to prevent accident.

Development of Stopper Design

Perhaps the first conspicuous progress was made with a porous earthenware stopper and about the middle of March, 1921, it was judged satisfactory. It had the following qualities in its favor:

1. It was hard and could be well shaped in manufacture.
2. It was tough and would withstand rough treatment without breakage.
3. It could be made as highly porous as necessary.
4. It was non-sulphating.

Later on a gasket was developed which gave great promise of filling the needs. It was made of a ¼-in. rope asbestos soaked in a mixture of paraffine and oil. This is 50 per cent machine oil and 50 per cent paraffine and is heated and thoroughly mixed and the asbestos rope soaked therein for about 5 minutes and then run through a grooved wringer to remove surplus material, allowed to solidify and cut into proper lengths for use. This gasket is flexible, compressible and tough. Easy application, low cost, tight closure and no discoloration of acid was claimed.

The Progress Report in August, 1921

Conclusions that had been reached in August, 1921, were:

1. Glass stoppers ground to fit and secured in place by burlap or other suitable fastening allowed for all acids. Note: It was thought unnecessary to forbid the use of chipped necks or cracked necks with this form of closure.
2. Glass stoppers with gasket: Not to be allowed.
3. Porous clay or earthenware stoppers with gaskets and fastenings under the following conditions:

(*a*) Allowed for all acids.

(*b*) Stoppers must be made of material sufficiently porous to prevent accumulation of interior pressure under ordinary conditions of transportation. The M. A.

Knight standard porous stopper is to be considered as a minimum for porosity.

(*c*) Stoppers must fit fairly closely inside the neck of the carboy. Shank of stopper must be at least 1¼ in. long and taper not more than ¼ in. on the diameter. Stoppers must have two cross-grooves in the upper surface with minimum depth at top of ¼ in. and maximum width of ⅜ in. Stoppers must be tough and not brittle.

(*d*) Gaskets must be made of asbestos rope (not less than ¼ in. commercial) soaked in a mixture of 50 per cent machine oil and 50 per cent paraffine at a temperature of about 250 deg. F. and subsequently wrung out and allowed to cool; other gaskets of similar physical qualities so that they will remain plastic and not disintegrate during use are also allowed.

(*e*) The "Brainerd" or similar efficient wire fastening or a lever fastening of type similar to the "Gem" must be used. Note: The use of a screw thread on inside of neck of carboy with corresponding thread on the stopper is to be investigated.

(*f*) Chipped lips not allowed unless the package will not leak when gasket and stopper are in place and without using some additional means such as plaster of paris.

The wire must be "Armco" or other acid-resisting iron wire dipped in asphalt paint. The diameter of this wire should not be less than some minimum size which will be investigated and determined later. Possibly 0.1 in. (10 gage B.&S. or 13 gage Birmingham) will be all right for the Brainerd closure, while 0.15 in. will be proper for the lever type closure.

Material Progress in the Development of the Carboy Neck-Grinding Machine

About this time the carboy neck-grinding machine was completed, a description of which was published in *Chem. & Met.* (vol. 27, page 1267, Dec. 27, 1922). This was a condition greatly to be hoped for and was considered of the highest importance on account of the fact that chipped and cracked necks of carboys are among the greatest difficulties to be overcome in securing a tight closure. The work on this machine was pushed to a satisfactory conclusion and a separate report rendered. The special recommendation was summarized as follows:

That glass carboys used for the shipment of corrosive liquids must have an even surface around the mouth in which to seat the gasket; this surface must be at least ¼ in. in width for carboys of 7 to 13 gal. capacity and at least ⅛ in. in width for carboys of less than 7 gal. capacity.

The development of this machine allows us to consider that all carboys may be prepared, before shipment, with a smooth surface for the gasket seat and thus do away entirely with the use of plaster of paris or other cement or clay mixtures, which have undesirable qualities, for the purpose of sealing.

Type of Wire for Fastening Also Studied

The investigation was continued to determine the amount of corrosion of wire fastenings when used with porous stoppers and also to endeavor to develop a wire-twisting device that would be more powerful and effective than the one ordinarily used for the Brainerd closure. A heavy type wire twisting tool was obtained after a very considerable delay and was tried out with heavy wire in several experiments, but without satisfactory results, as a strong tendency was noted to break the lip of the carboy due to the excessive pressure developed. Otherwise the tool and heavy wire were satisfactory.

Before formulating the final report certain special questions were brought up in a questionnaire, the answers being as follows:

(*a*) The venting of carboys closed by ground glass stoppers should not be recommended or allowed.

(*b*) The size of the inside diameter of the neck of carboy should not be recommended for standardization.

(*c*) The dimensions of cross-grooves in the upper surface of stoppers should be recommended as having a minimum depth of 1/32 in. and a maximum width of ⅛ in.

Final Recommendations of the Committee

The following recommendations were made by the committee and are reproduced verbatim from their final report:

General

1. The use of clay, plaster of paris and other similar mixtures for sealing carboys should be discontinued. It is possible to get a good seal in this way, but the high probability of getting a poor seal, the tendency of these mixtures to disintegrate during storage, the fact that a good seal is hard to remove and results in chipped and cracked necks, the fact that such a seal is frequently used to cover up serious chips and cracks in the mouth of the carboy, and the lack of necessity for such a seal when proper gasket, porous stopper and good flat seat on carboy mouth are used, make the use of such seals inadvisable.

2. Glass carboys used for the shipment of corrosive liquids should have an even, unchipped and uncracked surface around the lip on which to seat the gasket; this surface to be at least ¼ in. in width for carboy of 7 to 13 gal. capacity, and at least ⅛ in. in width for carboys of less than 7 gal. capacity. The "neck-grinding machine" described, illustrated and recommended in our report of April 18, 1922, makes this condition a commercial possibility.

3. The stoppers for carboys should be required to fit fairly closely in the mouth of the carboy and have a taper conforming closely to the taper of the inside of the mouth of the carboy.

4. The size of stoppers should be standardized as nearly as possible at not more than ½ in. less diameter (approximately) than the inside of the carboy neck.

Stoppers

5. Glass stoppers, ground to fit, should be authorized for all corrosive liquids, and should be secured in place by wire, cloth, burlap or other suitable fastening.

6. Clay or earthenware stoppers, porous, should be authorized for all corrosive liquids; they should be made of a material sufficiently porous to prevent accumulation of interior pressure under conditions of transportation or storage; they should be tough and not brittle, and of such material as will not be disintegrated by the corrosive liquid contained in the carboys. These stoppers should be of such size that the shank will fit inside the mouth of the carboy with not over ½ in. clearance. The shank of the stopper should be at least 1¼ in. long, and should taper not more than ¼ in. on the diameter; the upper surface of the stopper should have two cross-grooves with minimum depth of 1/32 in. and maximum of ⅛ in., measured at the center of the top; provided, that these stoppers, when made

with screw thread to engage in corresponding threads on inside of carboy neck, need not have the grooves in their upper surface.

7. Glass stoppers (plain or screw, but not ground to fit), clay and earthenware stoppers (not porous) and other similar stoppers should not be authorized for mineral acids or for other corrosive liquids liable to develop considerable interior pressure; such stoppers may be properly authorized under suitable conditions other than the foregoing, but which should be determined dependent on the particular article being shipped.

8. Asbestos rope, treated, should be authorized for use for any corrosive liquid that will not seriously disintegrate the gasket during use; these gaskets should be made of asbestos rope (not less than ¼ in. commercial) soaked in a mixture of 50 per cent machine oil and 50 per cent paraffine at a temperature of 250 deg. F. (approximate) and subsequently wrung out slightly and allowed to cool.

9. Flat asbestos, Rubberoid and other similar gaskets (not thoroughly plastic) should not be authorized for use for mineral acids or for other corrosive liquids liable to develop considerable interior pressure; they may be properly authorized under suitable conditions other than the foregoing, but which should be determined dependent on the particular article being shipped.

10. Other gaskets having physical properties similar to the treated asbestos rope gaskets, described above, so that they will remain plastic and not disintegrate during use, should also be authorized from time to time if found to be properly efficient in transportation and storage.

Stopper Fastenings

11. Wire fastenings of the type in which a wire is passed around the neck of the carboy just below the mouth and thence up over the stopper and twisted fast in a way to securely hold the stopper in place (such as the "Brainard" fastener) sould be authorized for all corrosive liquids; the wire should be required to be made of material as highly acid-resistant as practicable ("Armco iron" is recommended), and should be not less in size than No. 14 B.w.g. They should be coated with acid-resistant paint before using.

12. Wire fasteners of the lever type (such as the "Gem" fastener) should be authorized for all corrosive liquids; the wire should be made of material as highly acid-resistant as practicable and should not be less in size than No. 9 B.w.g. They should be coated with acid-resistant paint before using.

13. Metal screw cap fasteners, consisting of a cap to screw down over the thread on the outside surface of the mouth of the carboy should be authorized for all corrosive liquids; the thread should be required to be heavy and rounded to prevent chipping and should be made so that, with gasket and stopper in place, at least two full threads will be engaged; these caps should be made of material as highly acid-resistant as practicable and not less than No. 18 gage U. S. Standard in thickness. The cap may be allowed to have a hole in the top.

14. "Screw thread on stopper" fastening in which a thread on the shank of the stopper engages in a corresponding thread on the inside of the mouth of the carboy should be authorized for all corrosive liquids; the thread should be required to be heavy and rounded to prevent chipping, and should be made so that, with gasket in place, at least two full threads will be engaged.

15. Action should be taken to advise all users of carboys in regard to the desirability of instituting and enforcing such of the recommendations mentioned above as are considered acceptable.

16. The Bureau of Explosives should be requested to take appropriate action at some future date such that all concerned will have ample opportunity to prepare themselves for the change, to make obligatory and effective throughout the United States and Canada such of the foregoing recommendations as may be acceptable.

Comparison Made on Prices of Cement

The Cement Information Service has recently issued a statement of the facts concerning cement prices, profits, production and distribution, in reply to charges brought against the cement industry as a whole. It is stated that during the early part of 1915 some companies sold cement at 60 cents a barrel at their mills—a price admittedly below cost. Never before in the history of the industry had cement prices dropped so low. Many manufacturers refused to sell their product at that figure. Being confronted with serious financial difficulties, some plants were obliged to close. In reference to this, the Cement Information Service states that it is not fair to take the price of a commodity at an abnormally low point and during a temporary period as an indication of what a reasonable price should be.

A comparison between the price of cement and that of other building materials indicates that the price of cement did not rise to the high point reached by other building materials. Cement prices are therefore extremely low, considered relatively or absolutely. Let us compare today's price of the essential elements in the cost of cement with the price in 1914: Coal per ton delivered at the cement mill in 1914 cost $2.45. Coal now costs $6 per ton. Labor in cement plants in 1914 received on the average 20.1 cents an hour and now receives an average rate of about 42 cents an hour. Gypsum per ton at plant in 1914 cost $2.75. It now costs $6.20 per ton. Bags per 1,000 in 1914 cost about $82. Now bags cost about $215 per 1,000 due to the rise in the price of cotton from 7 cents a pound in 1914 to about 30 cents a pound today, and it takes four bags to make a barrel of cement.

Selling expense is also an important item in the cost of cement. Nineteen Eastern companies report that selling expenses increased on the average from 6.4 cents per barrel in 1914 to 12.5 cents per barrel in 1921. When existing conditions are taken into consideration, present figures for cement compare very well with those prevailing in 1915.

Resistance of Flow of Ore Through Beds of Solids

A large-scale apparatus has been devised at the Minneapolis Experiment Station of the Bureau of Mines for measuring the pressure encountered by a stream of ore in its passage through beds of lumps of coke and ore. More than 150 tests have been made. Three sizes of coke were employed (pea, nut and stove) and in each case it was found that the pressure drop varies as the square of the weight of air forced through a given bed. As yet the effect of the size of the coke on its specific resistance has not been determined. Experiments for the three cokes individually have been made and the binary system pea coke-stove coke has been completed.

Secondary Structures in Steel

Steel Solidifies in Dendrites of Delta Iron; Transformation Into Gamma Iron Involves Recrystallization Into Independent Granules of Austenite; Further Change Into Alpha Iron Causes Three Varieties of Secondary Structure

By Colonel N. T. Belaiew, C.B.

In 1913 Prof. Federico Giolitti communicated a paper to the Academy of Science of Turin, giving some observations on a piece of metal "whose structure did not correspond to Belaiew's dicta." I received a copy of that paper from Professor Giolitti on the eve of the great war and was unable then to more than glance at it. So that very interesting paper remained unanswered.

Dr. Giolitti also published a series of articles on the structure of steel in *Chemical & Metallurgical Engineering* during 1920. In the first of these, on "Crystallography of Alpha and Beta Iron," he gives a critical survey of my published views on primary and secondary crystallization and scheme of the three main secondary structures—viz., the network structure, the Widmanstättian structure, and the structure of large crystals. Then Professor Giolitti proceeds to give his observations on a sample of sheet steel having 0.32 per cent carbon, which had been heated about 5 months continuously at from 900 to 1,050 deg. C. and then cooled with the furnace, requiring 4½ days to drop from 1,000 to 150 deg. C. He says: "Belaiew's views would require such a piece to have a reticular structure, yet this metal has very coarse crystals and perfectly developed Widmanstättian structure." Thus his idea that ferrite is ejected to the periphery of homogeneous austenite on very slow cooling is not confirmed by study of a really uniform metal, which then actually gives Widmanstättian structure."

Instead of the author's hypothesis, Dr. Giolitti holds that "hypoeutectoid steels, especially, can therefore be classified and their structure explained by the hypothesis that beta iron assumes a granular and alpha iron a laminar habit." The real point at issue between the two views is, therefore, whether a definite type of structure is more or less linked up with certain allotropic modifications of iron, or whether it is dependent on thermal treatment only. Some of the differences undoubtedly arise from the fact that Dr. Giolitti was consulting an imperfect abstract found in a German journal of my early writings.

Three Types of Secondary Structures

My views on secondary structures in steel were first presented in various papers read before the Russian Technical Society in 1908 and 1909 and subsequently published in my thesis "On Crystallization of Steel on Slow Cooling" (Petrograd, 1909). In 1912 they were traversed again at some length in French in the *Revue de Métallurgie*[1] and in 1920 in English in a paper read before the Institution of Aëronautical Engineers.[2] They also formed the bulk of my two first lectures on "Crystallization of Metals" delivered in 1922 at the Royal School of Mines (University of London).

In proposing my scheme of three secondary structures, I had in view two main considerations: to bring in evidence first the crystallographic relations, and second the relation between these structures and the various areas of the well-known iron-carbon equilibrium diagram (Fig. 1). One of the most important determining factors is also the influence of previous processes on the condition of the metal immediately before secondary crystallization would start. Therefore, there are two of such processes now to be taken into consideration: the solidification process or "primary crystallization," occurring in the mushy zone between the liquidus and solidus lines and the process of "granulation" taking place in the austenitic zone.

Primary Crystallization results in the formation of dendritic crystals or dendrites in every alloy. After

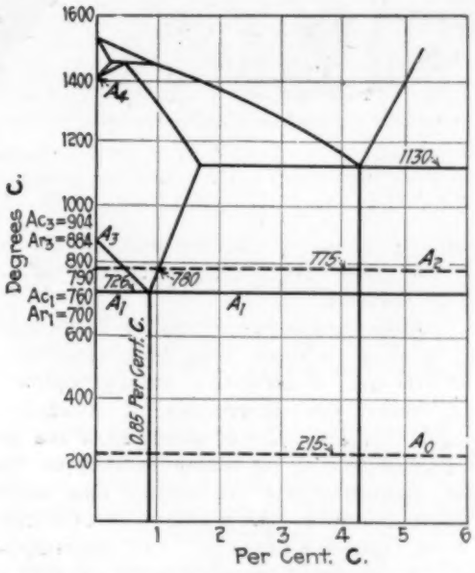


FIG. 1—IRON-CARBON DIAGRAM, AS PROPOSED BY HONDA

having completely solidified the alloy will be constituted of juxtaposed and interlocked dendrites. Every dendrite is a unit both from the crystallographical and chemical point of view. Alloys solidifying over a range of temperature—i.e., forming solid solutions—develop a chemical non-homogeneity in the dendrites which remains during its cooling and may be revealed at ordinary temperatures by proper methods. We say, therefore, that "development of macrostructure reveals dendritic structure."

The importance of primary crystallization has been sufficiently realized these last few years, and advantage taken of it. The same cannot be said about the subse-

[1] "Sur la Cristallisation et Structure des Aciers refroides lentement," *Rev. Mét.*, 1912, p. 321.

[2] "The Structure of Steel," *J. Inst. Aëronautical Engineers*, 1920, vol. 1, No. 3, p. 14.

quent phenomenon of granulation. A considerable amount of confusion appears to exist in the minds of several authorities, and the author feels compelled to re-cover the ground already traversed in his previous papers, some of which are quite inaccessible.

Granulation

On entering the austenitic zone every alloy is built up of dendrites; in leaving that zone, as the direct observations of Osmond and Baykoff show, every alloy is build up of "grains" or "granules."

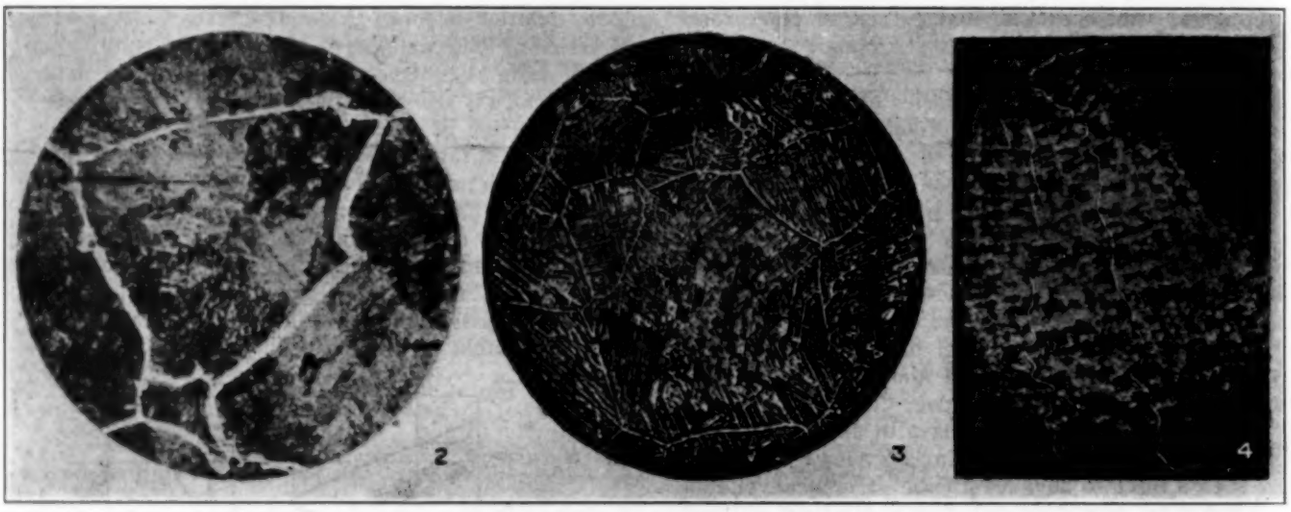
The structure of dendrites (Fig. 4), as already mentioned, can be revealed by macro-etching—for instance by the method of N. I. Belaiew (diluted picric acid), by the cupric reagent of Stead and Le Chatelier, or by one of the "Damascene etchings." The structure of the granules can be revealed by etching the steel while in the granulation zone by the method of Saniter or Osmond.[3] The same structure is revealed afterward by secondary deposits.

Dendrites have become very familiar to us now and it is well to bear in mind that that structure is a macrostructure—i.e., a structure usually visible by a naked eye, hence the dimensions of dendrites are usually large. The structure of granules or the general picture of granulation is but seldom seen by an unaided eye; larger magnifications are needed and hence the name of microstructure. As a rule a great number of granules arise from one dendrite. The dimensions and distribution of the dendrites of primary crystallization depend on conditions of cooling during solidification. Correspondingly, the dimensions and distribution of the granules depend on the conditions of cooling in the austenitic zone. These processes are different and independent and the resulting structures are also different and independent.

The process of granulation is governed by the same laws as every process of recrystallization in a solid crystalline body—i.e., nuclei are appearing at a certain rate and transformation starts from these with a certain linear velocity. As the conditions of cooling are altered the number and distribution of nuclei (and subsequently of crystalline grains) are also altered. The general character of the process, however, remains the same and the resulting structures remain polyhedral, as appears to be true for all known allotropic transformations.

Therefore the present author has advanced the view that the granulation process is linked up and even caused by an allotropic change in iron. In his view the granulation zone is the one true gamma zone, while in the area of primary crystallization the iron is in another modification (as some authors suggest it exists in the delta state).

The final result of the granulation process is the breaking up of every alloy in a number of crystalline polyhedral grains, every such grain or granule being an allotriomorphic crystal. So it happens that the crystallographic unity of dendrites is destroyed in the granulation zone; every alloy on leaving that area is built up of new crystallographic units. However, the chemical non-homogeneity of austenite (due to the mode of dendritic crystallization) remains, so that both of these structures can be revealed on every such alloy or piece of metal. Proper etching will reveal both the dendritic structure of primary crystals and the boundaries between the granules.



FIGS. 2 TO 4—TRIAD OF SECONDARY STRUCTURES

Fig. 2—Network structure. × 40. (Steel No. 5; carbon 0.60.)

Fig. 3—Widmanstättian structure. × 4. (Steel No. 8; carbon 0.60.)

Fig. 4—Dendritic structure with ferrite mesh. × 4. (Steel No. 6; carbon 0.60.)

Decomposition of Austenite

It is in such an alloy, built up of a number of allotriomorphic crystals or granules, that the decomposition of austenite into the excess constituent and pearlite occurs. Every granule possesses its own crystallographic orientation and all the elements of such a grain are crystallographically identical; but where different grains meet there must be a kind of neutral zone, or "no man's land," where the crystalline matter cannot assume the orientation of either of the grains. This thin layer, which according to Beilby, Rosenhain and others is in an "amorphous" state, seems predestined to facilitate the ejection of the first particle of the crystallizing pro-eutectoid element, the latter tending to form an envelope about the remaining austenite. Given sufficient time and other suitable conditions the whole of the excess element will be ejected to the periphery of the grain, forming a membrane

[3] "Microstructure of Iron and Mild Steel at High Temperatures," by H. S. Rawdon and Howard Scott., A.I.M.E., February, 1920, meeting. *Chem. & Met.* vol. 22, p. 787 (1920).

of a certain thickness. On a plain section such structure will be seen as a cellular or network structure (Fig. 2). Thus arises one of three secondary structures seen in steel.

Widmanstättian Structure

If the whole of the secondary deposit had time to segregate in this way a pure "network structure" would ensue. The main condition is a correct relation between the size of the grain and the velocity of crystallization. It is easy to see that the larger the size of the grains the more difficult it is to expect that the whole of the secondary deposit would collect at the boundaries. Then, if the process were to continue at a more accelerated pace in a coarse-grained metal, a certain proportion of the excess constituent would be forced to crystallize out "on the spot"—that is, not at the boundary but in the middle of the grain, whereupon the habit and the orientation of the crystalline austenite would be the dominant factors controlling the shape of the deposits. Ordinarily the latter would arrange themselves along the cleavage planes of the mother crystals. Cleavage planes in an octahedral grain are parallel to four faces of the octahedron. Ferrite precipitated along such planes would build up the appearance of Widmanstättian figures on a section. These Widmanstättian figures together with the network form the "Widmanstättian structure." (Fig. 3.)

Structure of Large Crystals

The third possible type of secondary structures would occur if the secondary deposits would lodge themselves parallel to the axes of the dendrites, reminding one of the crystal skeletons of the macrostructure. That will occur in the absence, total or partial, of granulation. Then the crystallographic unity of dendrites remains undestroyed and the elements of secondary crystallization lodge themselves preferentially parallel to the dendritic axes. Such structures may be seen either in hypereutectoid steels, where the granulation zone is nearly absent, or in large steel crystals like the famous Tshernoff crystal, when the granulation zone was apparently passed too rapidly. Such structure the author calls the structure of large crystals. (Fig. 5.) Together with the Widmanstättian and the network structure it forms the triad of secondary structures.

In my opinion the occurrence of various secondary structures is thus explained without assuming with Dr. Giolitti that beta iron assumes a granular and alpha iron a laminar habit. By studying the secondary crystallization and the subsequent formation of pearlite grain I have never been able to find any crystallographic or structural difference between the alpha and beta varieties. Recent X-ray studies seem to confirm this view, while they also confirm the existence of the delta modification.

Genesis of Secondary Structures

A series of steels were made in 1907 and 1908 according to my directions at the Poutilov and Ijewsky Works in Russia. The carbon content was about 0.60 per cent for alloys Nos. 5, 6 and 8 and 1.80 and 2.20 for alloys Nos. 1 and 2 respectively. All these steels were prepared under the conditions indicated by Anossoff and Tshernoff for the manufacture of Damascene steels—i.e., cooled at an extremely slow rate—the area of secondary crystallization was passed very slowly indeed and the deposition of ferrite lasted not less than 2 hours. The process of granulation was also very marked in the hypo-eutectoid alloys, the granules growing sometimes as large as 7 sq.cm. in cross-sectional area. Steels Nos. 5 and 6, prepared at the Poutilov Works, exhibited a pure network structure, but on a very large scale. On the other hand, alloy No. 8, made at the Ijewsky Works, exhibited a splendid Widmanstättian structure. Hypereutectoid steels gave the structure of large crystals.

The conditions of cooling at the Ijewsky Works differed from those at the Poutilov Works in that the steel ingots were stripped earlier, presumably during the process of secondary crystallization. Therefore I arrived at the conclusion that Widmanstättian structure will be favored by a somewhat greater cooling speed in the interval of secondary crystallization. These conditions would be present either when the velocity of cooling through the secondary range is not excessively low, or when a marked undercooling occurs after a very slow cooling. If a steel is undercooled the secondary crystallization—i.e., the throwing out of the free element—proceeds at a considerable velocity in spite of

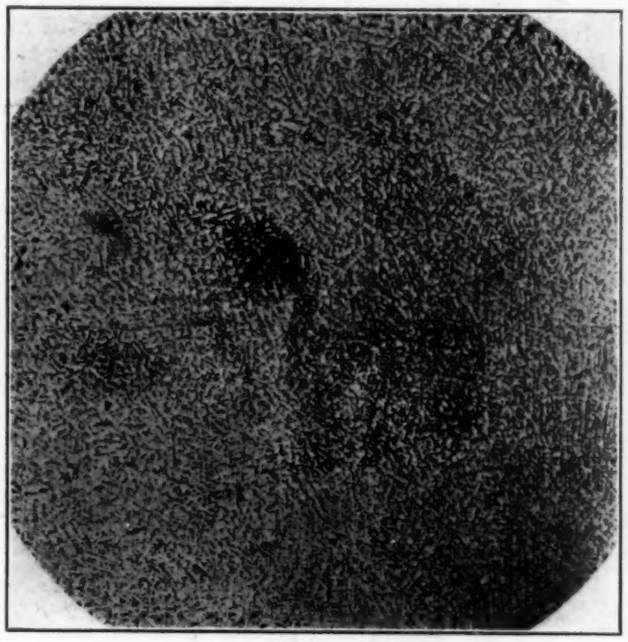


FIG. 5—STRUCTURE OF LARGE CRYSTALS
Cementite and pearlite in steel No. 1, carbon 1.80. × 1

the cooling being extremely slow, or the temperature even nearly stationary. In practice, this usually occurs in muffles, runners and the like; several instances were mentioned by the author in his thesis and have been noted by other writers.

The piece of sheet steel described by Professor Giolitti,[4] which had been heated for about 5 months continuously in the granulation zone and then cooled slowly, also comes under the heading. Its Widmanstättian structure is entirely in accordance with the present author's views. Here I would like to draw attention only to the importance of granulation and the size of the granules, in the production of such structures. The first and paramount condition for obtaining a well-defined Widmanstättian structure is the devel-

[4] "Crystallography of Alpha and Beta Iron," by Federico Giolitti. *Chem. & Met.*, March 31, 1920, vol. 22, p. 585. Fig. 5 of this article is incorrectly described. It is a view of steel containing but 0.60 per cent carbon. Fig. 6 should also be called "Structure of Large Crystals."

opment of large grains of austenite while in the granulation zone. Once that is achieved, it will be comparatively easy so to modify the velocity of secondary crystallization as to cause the largest possible amount of the free element to crystallize out along the cleavages of the large granules and produce the Widmanstättian figures.

The smaller the granules the greater must be the speed of secondary crystallization to produce the Widmanstättian structures.

In my 1909 thesis I insisted on the importance of a uniform orientation of the elemental octahedra in the large granules as the most important preliminary condition for the subsequent development of Widmanstättian structure. In other words, each grain must be a true crystal, as far as its internal arrangement is concerned. In my later French paper (1912) I also dwelt on the relation between the size of the granules and the velocity of secondary crystallization, and on the importance of undercooling to produce Widmanstättian structure. It is regrettable that my views were rendered somewhat incorrectly and the illustrations wrongly labeled in the text which was mainly used by Professor Giolitti.

It is very difficult to bring out simultaneously the white ferrite mesh of the network structure and the dendrites of primary crystallization. I attempted to show that the "dendritic" structure as a rule is in no way related to the secondary structure; in some cases one dendrite is cut up in a multitude of granules, in another, one granule or one ferrite mesh contains several dendritic systems. That idea has been considerably developed by the present author in his French paper and in the publications following. I should therefore like to take this opportunity of saying that on this point I am in complete agreement with the views of Professor Giolitti and would like to indorse the conclusions of the latter's paper on the "Relationship Between Dendritic Structure and Ferrite Mesh"[5]; I feel, however, that if rightly interpreted the dendritic structure showing thin ferrite meshes shown in Fig. 4 could find its place in the latter paper, alongside Professor Giolitti's very interesting photos.

Summary

To sum up, the present author believes that by suitably altering the velocity of cooling through the granulation zone and the zone of secondary crystallization any one of the three types of structures can be produced. So, for instance, my alloys Nos. 5 and 6 with 0.60 per cent C exhibit a macroscopic network structure; alloy No. 8 (C = 0.55 per cent) is a typical example of Widmanstättian structure, and my alloy No. 1 shown in Fig. 5 exhibits the structure of large crystals. The famous Tchernoff Crystal (C = 0.60 per cent) is the classic example of the structure of the latter.

This shows that the type of structure "depends in the first instance not on the chemical composition, but on the conditions of cooling, and brings into evidence the importance of crystallographic relation not only in crystals and isolated grains but in ingots and in every article manufactured of iron, steel or any other metal or alloy."[6]

London, England.

[5] *Chem. & Met.*, vol. 22, p. 930, May 19, 1920.

[6] "Crystallization of Metals," by Colonel N. T. Belaiew. London. University of London Press. 1922, p. 71.

Creating a New Industry

Prodigious Wood Waste Will Be Made Available for Industry by a New Process

AT THE present time, it is safe to say, not much over 40 per cent of the average timber tree gets into the shape of lumber at the mill. The waste of limbs, of unused portions of the trunk, of bark, of sawdust, of slabs and trimmings at the mills make up nearly 60 per cent of the total timber volume. Of course some of this material is burned to fairly good advantage and not infrequently some of it is available for paper making, but from the 30,000 sawmills in the United States the total loss from waste wood must be prodigious, so it is with considerable interest, from both the economic and the technical standpoint, that the recent announcement of the National Lumber Manufacturers Association has been welcomed. Two men on the Pacific coast, W. T. Dumbleton and W. A. Leuenberger, have developed a process for utilizing this wood waste in the form of briquet that will have a thermal value equal to that of the best anthracite coal.

What the Saving May Mean

The mill waste which may be used in this new development may amount in value to as much as 50 per cent of that of the large mills. In a fair-sized sawmill, producing 200,000 b.ft. of lumber per day, there will be 200 cords of waste material to dispose of. It is a wicked economic fact that more than half of this material is probably burned in waste burners because there is no market for its utilization. From such a mill the men referred to have produced over 60 tons of charcoal briquet at a manufacturing cost of $8 per ton, nothing being allowed for the cost of the material when the briquetting plant is operated in conjunction with the mill. In addition to this, 15 gal. of tar oil, 30,000 cu.ft. of wood gas and 7 gal. of acetone are recovered for each ton of briquet delivered. With that method of making briquets, it is entirely possible that they will find a use in the metallurgical industries on the Pacific coast, where they would be able to replace high-grade coals at roughly $15 per ton. If such a thing works out economically, it will undoubtedly prove a big boom to the industrial Northwest, where steel and pig iron have not been able to develop because of lack of good coking coal.

Possibilities of the Plan

From an economic standpoint, the saving is conceivably stupendous. The mills in Washington and Oregon produce 9,000,000,000 ft. of lumber a year. If they were all to introduce this new carbonizing and briquetting process, their waste would make 2,700,000 tons of briquets a year, enough to meet the requirements of the section for high-grade domestic fuel as well as prospective metallurgical requirements on a large scale. Applied to the entire amount of the lumber output of the United States, the potential amount of fuel of equal quality to anthracite realized by this process would be close to 10,000,000 tons. The same land that makes briquets can produce acetone, tar oil and gas with some comparatively inexpensive additional pieces of equipment, and this would net roughly 2,500,000 gal. of tar oil, 5,000,000 cu.ft. of gas and 1,000,000 gal. of acetone each year.

In addition to these figures can be added some considerable savings due to the use of logging wastes, which are about as large as those of the mill waste.

Evaluation of Decolorizing Carbons

It Is Contended That Present Empirical Methods Should Be Replaced by General Adsorption Data

By Marshall T. Sanders
Atlas Powder Co., Wilmington, Del.

ALTHOUGH decolorizing carbons have been of commercial importance for a decade or two, there is as yet no standard method for evaluating them. Each manufacturer and each buyer has his own test. One selects bone black or some carbon as a standard, and, more or less arbitrarily, says that his product is, perhaps, thirty times as efficient; another rates his product on its "decolorizing power," a test dependent upon percentage of color removed by a given quantity of carbon from a certain solution. A third tries to measure the amount of dye which he can add to an aqueous suspension of the carbon without coloring the water. In all of these methods lies a common fallacy. A straight line cannot be determined by one point, nor is one equation with two unknowns capable of definite solution. It has been shown that decolorization is an adsorption phenomenon. The empirical adsorption equation most widely used in relation to experimental data dealing with adsorption is that proposed by Freundlich:

$$\frac{X}{M} = kC^{\frac{1}{n}}$$

where X is the amount of solute adsorbed by M grams of the absorbent and C is the concentration of this material remaining in the solution at equilibrium. Both k and n are empirical constants and any method of evaluating decolorizing carbons must take into consideration the fact that there are two of them.

Methods of Measuring Color

The evaluation of decolorizing carbons postulates the measurement of color, so it might be well to consider immediately the commercially used methods for measuring color of liquids.

There are three of these methods:

(1) The use of Nessler tubes or a Duboscq type of colorimeter.

(2) The use of instruments in which the color of the liquid is matched with tinted glasses.

(3) The use of instruments depending on the measurement of the extinction coefficient for certain wave lengths of light.

Nessler tubes or the Duboscq colorimeter are used only when the colors of the unknown and known samples can be perfectly matched by the dilution of one of them. If several coloring matters are present and are not in the same proportions in both samples, the tints will be different, and a match of the colors practically impossible. L. W. Parsons and R. E. Wilson[1] have found that a Duboscq colorimeter may be used for the measuring of the color of certain oils. In our work with sugars, however, we have found that the color of the decolorized solution cannot be matched with any dilution of the original sample. In such a case, either Nessler tubes or Duboscq colorimeter are useless.

The Lovibond tintometer is an example of the second class of instruments. The chief drawbacks of these instruments are the large assortment of colored glasses necessary, the rather long time consumed in taking a reading, the difficulty of checking results and of two operators reading a given solution alike. Parsons and Wilson in the article referred to above also point out that the Lovibond color scale is not directly proportional to the true color scale. This may be due in part to the loss of light by reflection from the many surfaces exposed when a number of colored slides are used.

In the third class fall spectrophotometers, and possibly the Hess-Ives tintphotometer. A spectrophotometer would doubtless be far better than the Hess-Ives tintphotometer, but the original cost and the care needed for its operation disqualify it for ordinary laboratory work. The color screens of the Hess-Ives tintphotometer transmit rather wide regions of spectrum. However, we have found it quite satisfactory in our type of work.

Modified Units for Hess-Ives Instrument

Meade and Harris[2] propose a system of units for use with the Hess-Ives tintphotometer. These units are based on the extinction coefficient. Meade and Harris give equal weight to the units representing red, green and blue violet light. The units which we use are those of Meade and Harris, weighted by the luminosity of each color. A system of these units is given in Table I.

The writer believes these modified units more closely represent the color of a solution as it affects the human eye than do those of Meade and Harris. The scale read-

TABLE I—SPECIAL UNITS FOR USE WITH HESS-IVES TINTPHOTOMETER

If X = color units and Y = scale readings

Red, $Y = 100E^{-0.05299X}$

Green, $Y = 100E^{-0.01418X}$

Blue Violet, $Y = 100E^{-0.1006X}$

Scale Reading	*R*	*G*	*BV*	Scale Reading	*R*	*G*	*BV*
1	87.1	325.2	45.8	51	12.7	47.6	6.7
2	73.9	276.0	38.9	52	12.4	46.2	6.5
3	66.4	248.0	34.9	53	12.0	44.8	6.3
4	60.8	227.0	32.0	54	11.7	43.5	6.1
5	56.6	211.5	29.8	55	11.3	42.2	5.9
6	53.2	198.7	28.0	56	11.0	41.0	5.8
7	50.2	187.4	26.4	57	10.6	39.7	5.6
8	47.7	178.2	25.1	58	10.3	38.5	5.4
9	45.5	170.0	23.9	59	10.0	37.3	5.3
10	43.5	162.5	22.9	60	9.7	36.1	5.1
11	41.6	155.5	21.9	61	9.4	34.9	4.9
12	40.1	149.7	21.1	62	9.1	33.8	4.8
13	38.6	144.0	20.3	63	8.8	32.7	4.6
14	37.2	138.1	19.6	64	8.5	31.5	4.4
15	35.9	134.1	18.9	65	8.2	30.4	4.3
16	34.6	129.1	18.2	66	7.9	29.3	4.1
17	33.5	124.9	17.6	67	7.6	28.3	4.0
18	32.4	120.7	17.0	68	7.3	27.3	3.8
19	31.4	117.1	16.5	69	7.0	26.3	3.7
20	30.4	113.6	16.0	70	6.8	25.2	3.6
21	29.5	110.0	15.5	71	6.5	24.1	3.4
22	28.6	107.0	15.1	72	6.2	23.1	3.3
23	27.8	103.6	14.6	73	5.9	22.2	3.1
24	27.0	100.7	14.2	74	5.7	21.2	3.0
25	26.2	97.8	13.8	75	5.4	20.3	2.9
26	25.5	95.2	13.4	76	5.2	19.4	2.7
27	24.8	92.4	13.0	77	4.9	18.5	2.6
28	24.1	89.9	12.7	78	4.7	17.5	2.5
29	23.4	87.4	12.3	79	4.5	16.6	2.3
30	22.7	85.0	12.0	80	4.2	15.8	2.2
31	22.1	82.7	11.7	81	4.0	14.9	2.1
32	21.5	80.4	11.3	82	3.8	14.1	2.0
33	21.0	78.3	11.0	83	3.5	13.2	1.9
34	20.4	76.2	10.7	84	3.3	12.4	1.7
35	19.8	74.1	10.4	85	3.1	11.5	1.6
36	19.3	72.2	10.2	86	2.9	10.7	1.5
37	18.8	70.2	9.9	87	2.6	9.8	1.4
38	18.3	68.3	9.6	88	2.4	9.0	1.3
39	17.8	66.5	9.4	89	2.2	8.2	1.2
40	17.3	64.7	9.1	90	2.0	7.5	1.1
41	16.8	63.0	8.9	91	1.8	6.7	0.9
42	16.4	61.2	8.6	92	1.6	5.9	0.8
43	15.9	59.6	8.4	93	1.4	5.1	0.7
44	15.5	57.9	8.2	94	1.2	4.3	0.6
45	15.1	56.4	7.9	95	1.0	3.6	0.5
46	14.7	54.8	7.7	96	0.8	2.8	0.4
47	14.3	53.3	7.5	97	0.6	2.1	0.3
48	13.9	51.8	7.3	98	0.4	1.4	0.2
49	13.5	50.3	7.1	99	0.2	0.7	0.1
50	13.1	48.9	6.9	100	....	....	....

[1] *J. Ind. Eng. Chem.*, vol. 14, p. 269 (1922).

[2] *J. Ind. Eng. Chem.*, vol. 12, p. 687 (1920).

ing of the Hess-Ives tintphotometer for each screen is translated to "units of color" for that screen. The sum of these values for each screen is taken as the color of the solution.

It is the writer's desire to take exception to a recent statement[3] that the color units read by viewing a ½-in. layer of liquid are not twice the value determined by viewing a ¼-in. layer. The law for the absorption of light by a transparent colored liquid is:

$$\frac{I}{I_o} = E^{-kcd}$$

where I is the intensity of the transmitted light
I_o the intensity of the incident light
E the base of natural logarithms
k a constant
c the concentration of the light-adsorbing substance
d the thickness of the layer of liquid.

It is a well-known fact that if a colored substance suffers change on dilution, this law does not hold rigidly, but there is no evidence to sustain the opinion previously stated. The writer has found in the case of sugar and molasses solutions that when the thickness of the layer of liquid is doubled the "color units" also double.

At the fall meeting of the American Chemical Society in 1921, Dr. F. W. Zerban presented a paper in which he stated that he had found that the removal of color by carbons follows the adsorption equation, and that by using the Meade-Harris color units in place of the concentration terms X and C in the adsorption formula

$$\frac{X}{M} = kC^{\frac{1}{n}}$$

he had obtained straight lines for the plotted relations of the log $\frac{X}{M}$ to log C.

The modified Meade-Harris units, given in Table I, may be used equally as well in place of the concentration terms X and C. When X and C were expressed in these modified Meade-Harris units, the plot of log $\frac{X}{M}$-log C was a straight line in all cases tested by the writer, except for that end of the curve corresponding to very small quantities of carbon and a consequent slight color removal. It is believed that the determination by the Hess-Ives tintphotometer of the color removed and the use of the modified Meade-Harris units will be found a satisfactory method. However, as has been pointed out above, the Duboscq colorimeter may be used with assurance of accurate results in certain special cases.

Conclusions

In view of the fact that the adsorption equation satisfactorily represents the action of a decolorizing carbon in any given case, it seems that the logical way to evaluate decolorizing carbons is by means of the adsorption isotherm. Furthermore, as the constants of the equation (k and n) are for one particular coloring matter and one initial concentration of that coloring matter, the action of the various decolorizing carbons should be determined for the particular solution it is intended to decolorize.

D. C. Henry[4] is of the opinion that the exponent $\frac{1}{n}$ is the ratio of the osmotic work of adsorption to the total work $\frac{RT}{RT + W}$ where W is the non-osmotic work of adsorption. If this is the case $\frac{1}{n}$ will vary with the coloring matter to be removed. There is no apparent reason why the action of the carbon in one case should be of itself any criterion for its action in any other. It is a well-known fact that often a carbon that is more efficient than another in one case is less efficient in another case.[5] Suppose in the decolorization of a given solution by each of two carbons, that the exponents $\frac{1}{n}$ for these carbons are not identical. Then the efficiency of the two carbons will vary with the color of the solution after decolorization.

We are now in a position to see the fallacies of the present methods of comparing decolorizing carbons. To say that one carbon is so many times as efficient as another is valueless. To rate a carbon on its "decolorizing power" or on some arbitrary test with a dye, while it is a step in the right direction, is inconclusive and misleading. The carbon will probably be used on some solution other than the one on which it was standardized. Even if by chance this should not happen, still by these methods only one point on the adsorption isotherm is determined, and the position or direction of the curve remains unknown.

The ultimate method for evaluating decolorizing carbons must take into account two factors. The various carbons do not act similarly on different solutions and the action of decolorizing carbons, being an absorption phenomenon, follows the adsorption equation.

[3] By F. E. Thomas, in the last paragraph of p. 162, *International Sugar Journal*, 1921.

[4] *Phil. Mag.*, vol. 44, pp. 689-705 (1922), through *Chem. Abs.*, vol. 17, p. 11 (1923).

[5] A. B. Bradley, *Int. Sugar Journal*, vol. 23, pp. 25-32 (1921); vol. 23, pp. 455-62 (1921).

Increase in Copper Metal Exports

According to *Commerce Monthly*, exports of copper from the United States in 1922 showed a gain of 16 per cent over 1921 and were only 11 per cent below the pre-war average. The declines, as compared with 1921, in shipments to Germany and Japan were more than offset by the gains in exports to Italy, France, the United Kingdom and Belgium.

Ninety per cent of the exports in 1922 was in the form of refined copper, in bars and ingots, 7 per cent as copper rods, less than 2 per cent as uninsulated wire and 1 per cent as plates and sheets. Exports of unrefined, old and scrap copper were under 1 per cent.

Copper exported from the United States meets as its chief competitors in the international market the exports from Australia, Japan, Spain and Africa. Chile, Peru, Canada and Mexico likewise export large quantities, but most of their shipments, either because of financial control or for convenience in shipment, are sent to the United States. A large part of this output is refined here. As a refinery requires a large capital investment, the refineries of the United States play a large part in this country's control of the market.

The ease with which copper may be worked led to its use in many household utensils, although in the Western world it has been displaced in this use to some extent by aluminum and enameled steel. In Eastern countries copper and brass are still almost the only materials from which domestic utensils are made, and large quantities of those metals are imported.

Engine Experiments With Oxidized Oils*

By J. H. James and F. C. Zeisenheim
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Engine experiments with a fuel made by the catalytic oxidation of kerosene and a fuel of similar character made by the oxidation of gas oil show that the oxidized kerosenes develop approximately the same power as ordinary kerosene, in spite of the fact that their thermal value is one-eighth less. It is believed that there is a better "clean-up" in the combustion of these partly oxidized fuels, which accounts for their efficiency. These oxidized kerosenes show lower detonation tendencies than the straight hydrocarbon fuel. Similar experiments with lower boiling oxidized fuels in an automobile engine gave results which show that the above results hold here as well.

IT WAS pointed out in a previous article[1] that in the catalytic oxidation of petroleum hydrocarbons there is always a portion of the product having a lower boiling range than that of the raw material, and for convenience this was called "oxidized kerosene." As shown by the distillations of the oxidation products used in the experiments described in the present paper, this material always had between 20 and 35 per cent boiling under 200 deg. C., while the upper limit in every case was taken at 300 deg. C.

Further it was noted in the earlier paper that the fuel value of these products was about one-eighth less than that of ordinary petroleum hydrocarbon mixtures boiling within the same range.

Reasoning from the work of other investigators, particularly that which had been done on alcohol, it was believed that these oxidized kerosenes might show desirable properties when used as a fuel in an internal combustion engine. To test out this idea, the experimental runs described here were made, particular attention being paid to the behavior of the engine as to any "knocking" or detonating characteristics of the fuels, as well as to the power developed in each case.

The fuels tested were: (1) Ordinary kerosene (for comparison), (2) oxidized kerosene made by the oxidation treatment of Pennsylvania kerosene and taking the portion boiling up to 300 deg. C., (3) oxidized kerosene made in the same way from high-sulphur Mexican kerosene, (4) oxidized kerosene made by applying the oxidation treatment to Mexican gas oil, and distilling out the portion boiling up to 300 deg. C.

The Engler distillations of the fuels used in the kerosene engine tests and the later automobile tests are given in Table I.

Stationary Engine and Automobile Tests

The kerosene engine used in the first set of experiments summarized in Table II was a one-cylinder, 10-hp., 375-r.p.m., Mogul No. H507, made by the International Harvester Co., of Chicago, and kept in somewhat intermittent use for instructional purposes in the Automotive Laboratory of the Carnegie Institute of Technology. This engine is provided with attachments for "warming up" on gasoline. Lubrication is by forced feed. The water injection is provided for lessening the detonation common with kerosene engines and the readings of this adjustment bring out an important characteristic of the oxidized kerosenes.

Table II gives the more important readings taken; in every case the engine was warmed up by running on gasoline.

Additional experiments bearing on the same line were tried as follows on the two oxidized fuels within the gasoline range:

The motor fuel No. 1 was tested in a six-cylinder car (28 hp.) which was run for 90 miles under all sorts of city traffic conditions, yielding 20 miles per gallon, under the same conditions which gave with ordinary "58-60" gasoline 14 to 15 miles per gallon. The most marked feature of the test was the freedom from detonation with spark advanced and on hills, where the "58-60" fuel gave persistent knocking.

Discussion of Results

The No. 2 fuel was used in a touring test in the same car with the following results:

Lighter gasoline was needed for priming the cold engine. The road-touring test consumed 10.8 gal. of the fuel, giving an average of 16.5 miles per gallon.

TABLE I—CHARACTERISTICS OF FUELS USED IN ENGINE TESTS

	Oxidation Products From High-Sulphur Mexican Kerosene	Oxidation Product (up to 300 Deg. C.) From Mexican Gas Oil (b)	Motor Fuel No. I	Motor Fuel No. II	Pennsylvania Kerosene	Oxidation Product From Penna. Kerosene (up to 300 Deg. C.)
Sp.gr. at 15.6 deg. C.	0.8515	0.903	0.798	0.798	0.800	0.847
Initial bp., deg. C.	110	110	72	82	193	112
Up to 105 deg. C., per cent	.....	.....	6.5	2	.....	.....
125 deg. C., per cent	2	2	25	8	.....	3
140 deg. C., per cent	.....	.....	43	19	.....	.....
150 deg. C., per cent	5	6	54	23	.....	11
175 deg. C., per cent	11	10	80	45	.....	21
190 deg. C., per cent	.....	.....	91	60	.....	.....
200 deg. C., per cent	23	17	94	70	3	34
225 deg. C., per cent	44	20	(c) 98	.....	24	43
250 deg. C., per cent	68	28	.....	(d) 99	58	56
275 deg. C., per cent	86	40	.....	.....	84	76
300 deg. C., per cent	98	60	.....	.....	96	96
350 deg. C., per cent	.....	90	.....	.....	.....	.....
End point, deg. C.	300	.....	218	253	300	300
Distillation loss, per cent	2	(a) 10	.....	.....	4	4
Organic acids Not removed for test, per cent	9.2	20	15 (All removed)	.....		11

(a) Residue plus distillation loss.
(b) A distillation of this product was made cutting out portion below 300 deg. C for the engine test.
(c) Up to 218 deg. C. (d) Up to 210 deg. C. = 80 per cent, 220 deg. C. = 90 per cent and 99 per cent recovered at end point.

*A paper presented at the Richmond meeting of the American Institute of Chemical Engineers, Dec. 8, 1922.
[1] "Some New Petroleum Products," by J. H. James, *Chem. & Met.*, vol. 26, No. 5, pp. 209-12 (1922).

With spark advanced almost no detonation was observed at any stage of the run. Similar tests with "58-60" gasoline gave about the same mileage, but noticeable detonation.

Realizing that part of the foregoing results on the oxidized kerosene were obtained because of the presence of the fraction boiling below 200 deg. C., it should be pointed out that this portion does not have the ordinary gasoline distillation curve by any means; hence, if we call the portion from 200 to 300 deg. C. kerosene, the under 200 deg. portion resembles, as far as its distillation goes, a heavy naphtha. Looked at in this light, these oxidized fuels up to 300 deg. C. might be regarded as mixtures of ordinary kerosene with heavy naphtha, in ratios from 4:1 to 2:1.

As bearing on this point, an engine run was made

TABLE II—RESULTS OF ENGINE EXPERIMENTS WITH VARIOUS OXIDIZED FUELS

Reading No.	Time	Rpm.	Brake Hp.	Fuel Weight Lb.	Fuel Used Between Readings	Fuel Used Per Bhp.-Hr.	Cooling Water In	Cooling Water Out	Air Heater	Exhaust	Fuel Adj.	Water Adj.	Remarks
							Temperatures (Deg. C.)						
							Ordinary Commercial Kerosene (Penna. Petroleum)						
							Series 1a						
1	P.M. 4:35	394	9.17	17.344	.....	.....	55	64	60	425	4	8	These readings made as a trial in getting all adjustments. Preliminary trials without water injection showed extremely bad detonation.
2	4:45	392	9.17	15.750	1.594	1.043	58	69	60	423	4	8	
		Av. 393											
							Series 1b						
3	4:58	392	....	13.906	.....	.....	65	75	54	480	4	11	This run determined the maximum water injection the engine would stand and carry the load. The detonation was still marked.
4	5:08	392	9.14	12.688	1.218	0.799	65	75	55	470	4	11	
5	5:18	391	9.13	11.000	1.688	1.110	65	77	57	490	4	11	
6	5:28	396	9.17	9.375	1.625	1.063	66	79	57	490	4	11	
7	5:38	391	9.17	8.000	1.375	0.900	67	76	57	495	4	11	
	40 min.	Av. 392.4	Av. 9.15	Used 5.906	Total 5.906	Av. 0.968							
							Oxidation Product From Penna. Kerosene (Up to 300 Deg. C.)						
							Series 2a						
8	A.M. 11:35	397	....	25.875	.....	.....	57	69	52	460	4	.0	Readings 8 and 9, detonation noticeable, but not so pronounced as with "no water" trials with ordinary kerosene. Readings 10 and 11, detonation was practically silenced by this water adjustment.
9	11:50	...	6.33	.....	.....	.....	64	81	60	470	4	0.0	
10	11:53	403	6.38	.....	.....	.....	65	81	63	480	4	4.0	
11	P.M. 12:01	403	6.39	.....	.....	.....	65	78	64	450	4.3	4.0	
12	12:11	395	6.33	.....	.....	.....	65	79.5	63	470	2.3	0.0	
13	12:21	394	6.26	.....	.....	.....	67	82	66	475	2.4	0.0	
14	12:25	.....	....	19.938	5.937	1.125	..	....	..	...	...	...	
	50 min.	Av. 398.4	Av. 6.35										
							Oxidation Product From Penna. Kerosene (Up to 300 deg. C.)						
							Series 2b						
15	P.M. 2:45	395	9.25	16.750	.....	.....	49.5	64.0	61	...	3.5	8	This water adjustment practically eliminated detonation.
16	2:55	398	9.25	15.375	1.375	0.892	58.5	68.0	62	...	3.5	8	
17	3:05	393	9.22	14.063	1.312	0.853	62.0	72.0	63	540	3.5	8	
18	3:15	397	9.21	12.563	1.500	0.977	64.0	74.5	64	530	3.5	8	
19	3:25	390	9.17	11.188	1.375	0.900	65.0	77.0	59	520	3.5	8	
	40 min.	Av. 394.6	Av. 9.21	Used 5.562	Total 5.562	Av. 0.916							
							Series 2c						
20	3:44	381	....	17.750	.....	.....	71.0	90.0	58	520	3.5	0.0	No water injection. Some detonation. Lower horsepower and higher fuel consumption.
21	3:54	379	7.98	16.125	1.625	1.22	73.5	97.0	59	520	3.5	0.0	
22	4:04	.....	....	14.313	1.812	.....	69.0	91.0	59	495	3.5	0.0	
	20 min.	Av. 380		Used 3.437	Total 3.437								
							Oxidation Product From High Sulphur Mexican Kerosene (Up to 300 Deg. C.)						
							Series 3a						
23	2:00	398	8.68	20.625	.....	.....	54	75	47.5	485	3.3	5.0	Exhaust clear. Lean fuel setting. Water injection sufficient to quiet detonation to "bomp, bomp" condition.
24	2:10	398	8.68	19.500	1.125	0.778	58	75	52.5	497	3.3	5.0	
25	2:20	398	8.67	18.313	1.187	0.82	61	82	54.0	500	3.3	5.0	
26	2:30	397	8.67	16.718	1.595	1.103	63	84	56.0	505	3.3	5.0	Spark at full advance.
27	2:40	398	8.68	15.500	1.228	0.843	64	86	57.0	502	3.3	5.0	Amount of water used for injection 3.35 liters.
28	2:50	398	8.68	14.125	1.375	0.951	64	90	57.5	500	3.3	5.0	
29	3:00	.....	....	12.813	1.312	.....	64	85	58.0	500	3.3	5.0	
	60 Min.	Av. 397.3	Av. 8.68	Used 7.812	Total 7.812	Av. 0.899							
							Series 3b						
30	3:11	388	....	10.938	.....	.....	64	83	56.0	490	3.5	10.0	Trial for maximum load with this fuel. Exhaust had slight blue haze, odor not noticeable. Water injection as set entirely quieted detonation.
31	3:21	386	12.12	9.063	1.875	0.928	63	80	56.0	480	3.5	10.0	
32	3:31	372	11.88	7.250	1.813	0.916	62	80	56.0	480	3.5	10.0	
33	3:41	.....	.....	5.250	2.00	.....	60	77	53.0	450	3.5	10.0	Throttle nearly wide open as set by governor with speed below normal.
	30 Min.	Av. 382	Av. 12.00	Used 5.688	Total 5.688	Av. 0.922							
							Series 3c						
34	3:50	398	....	10.250	.....	.....	59.0	75	56.0	485	3.4	6.5	Half load test on this fuel. Water injection was set at quiet running, but some "bomp, bomp" was noticeable. Exhaust had slight haze at first, but became clear.
35	4:00	400	6.79	9.25	0.938	0.829	60.5	74	57.0	465	3.5	6.0	
36	4:10	400	6.81	8.125	1.25	1.10	58.0	80	58.0	480	3.5	6.0	
37	4:20	.....	.....	.....	1.00	.....	60.0	83	57.0	480	3.5	6.0	
	30 Min.	Av. 399	Av. 6.80	Used 3.188	Total 3.188	Av. 0.965							
							Oxidized Kerosene Made From Mexican Gas Oil						
							Series 4a						
38	A.M. 11:00	394	.....	14.188	.....	.....	60	73	43.0	440	5.0	5.5	Water injection sufficient to bring detonation down to the "bomp, bomp" condition. Would take no more water and hold load. Exhaust showed considerable smoke with a very pungent odor. This is the leanest mixture would run engine for this load.
39	11:10	398	8.64	12.500	1.688	.....	61	76	45.5	445	5.0	5.5	
40	11:20	400	8.71	10.563	1.937	1.172	62	77	44.0	450	4.0	5.5	
41	11:30	398	8.71	9.500	1.063	1.335	62	80	48.0	490	4.0	5.5	
42	11:40	397	8.67	8.063	1.437	0.733	62	78	46.0	440	5.0	5.5	
43	11:50	394	8.63	6.625	1.438	0.995	62	80	47.5	450	5.0	5.5	
44	12:00	.....	.....	5.000	1.625	1.000	62	83	44.0	...	5.0	5.5	
	60 Min.	Av. 396.83	Av. 8.67	Used 9.188	Total 9.186	Av. 1.047							
							Series 4b						
45	4:30	400	.....	10.250	.....	.....	61	85	54.0	480	3.5	5.0	Lighter load than 4a test. Exhaust clear. Engine ran evenly. "Bomping" noticeable but not objectionable. Injection water used 0.73 liter.
46	4:40	402	6.82	9.250	1.000	0.88	62	80	57.5	500	4.0	5.0	
47	4:50	.....	....	8.125	1.125	.....	62	84	60.5	500	4.0	5.0	
	20 Min.	Av. 401	6.82	Used 2.125	Total 2.125	Av. 0.88							

with the oxidized Mexican kerosene in the automotive laboratory of one of the large oil companies. The behavior of this fuel as to detonation was checked against a kerosene-gasoline mixture that would give the same low detonation characteristics. It was found that a mixture of 60 per cent kerosene and 40 per cent gasoline was required to bring ordinary kerosene down to that of the oxidized kerosene in low detonating character.

When we note that all the oxidized fuels tried in the kerosene engine have one-eighth lower thermal values than ordinary hydrocarbons within the same distillation range and still gave as good or better efficiencies than ordinary kerosene, the writers believe that we must look to the chemical character of the mixtures for the explanation. According to this idea the original hydrocarbon molecules are weakened toward the oxidation attack in the internal combustion engine because of their oxidized character, so that a better "clean up" results, and perhaps more of a propulsive effect during the explosion which is evidenced by a diminution of the detonation.

Gum Formation With Oxidized Fuels

In the discussion following the presentation of Professor James' paper at the Richmond meeting, Wilbert J. Huff, of the Koppers Co., asked the author if he has noticed any gum formation in the use of this fuel. It was pointed out by the inquirer that gum formation is a very fundamental question in the use of fuels in internal combustion engines and that an investigation by the Bureau of Mines had shown that oxidized gasoline gives a heavy yield of gums. Professor James declared that most of the gum is in the fraction over 300 deg. C. As bearing on the gum formation problem, the oxidation product fractions over 300 deg. C. were made into a lubricating oil by careful vacuum distillation and were used in the same kerosene engine described in the previous tests. There was no varnish-like formation with this lubricant, and the carbon formed was only about half that formed from the well-known commercial engine oil lubricants. This carbon was of a light, fluffy character. Professor James believes that here again the chemical character of the oil is the determining factor in the cleaner combustion.

What Real Co-operation Can Do for the Edible Oil Industry

Manufacturers' Nearsighted Policy of Secrecy Declared a Serious Obstacle to Technical Progress*

By John P. Harris
Chemical Engineer, Kansas City, Mo.

OF COURSE we all hate to admit it, but, if we are honest with ourselves, we must acknowledge that the art of edible oil refining has progressed less since its inception than any other branch of applied chemistry. However, we are not willing to admit that this is due to any inferiority of the technical men engaged in this industry, but rather because practically all of the edible oil manufacturers have made a great fetish of secrecy, even introducing this pernicious practice into their own organizations, so that only the chosen few shall know the "wonderful secrets" by which their efficienecy is obtained, with the idea of keeping their quality high above their competitors'. In view of this selfish and near-sighted policy, it is really rather remarkable that the industry has progressed as far as it has. We can readily understand the manufacturers' viewpoint, their idea being to stifle competition and obtain a virtual monopoly upon that business, or at least secure a preference by the discriminating trade.

Exchanging Technical Information

A few years of real co-operation would make a tremendous difference in the edible oil industry. A few years of pulling together and "speaking out in meeting" would mean a great deal to everyone. The power of suggestion is a wonderful thing and when Jones of the John Doe Co. suggests to Smith of the Richard Roe Co. that we are doing thus and so in our neutralizing process, Smith tries it out, adds his own individual ideas to it and obtains even better results than Jones. He then tells Jones about it, and Jones tries out Smith's suggestions, which he improves by adding some new ideas of his own, and so on ad infinitum. The entire industry becomes stimulated, and undreamed of improvements and economies result.

Would it not be wonderful if we could attend a convention where no one attempted to secure all the information possible from everyone else, at the same time withholding all of his own information and intentionally deceiving everyone else, with the result that no one profits by attending the convention?

Of course we must realize that no firm is ever going to be broad gage enough to sacrifice profits for the uplifting of the industry, but what we do insist is that the sort of co-operation we have mentioned, which sounds like the coming of the millennium, would be of benefit to everyone in the long run, and that the most efficient concerns and those who do the greatest amount of advertising would be the ones to profit most.

Many employers of laborers condemn labor unions because they do not help raise the standard of labor. And yet those very men belong to trade organizations possessed of wonderful potential possibilities for the advancement of their industries, which have never made one single move for the production of higher quality products by that industry.

And the vegetable oil industry is no exception. There is not one concern in the industry which is producing the very best product of which it is capable, even though a part of its product may be very superior. And many concerns, through ignorance or through a near-sighted policy of "getting by" with the least possible cost, are producing a product which is so poor that it is consumed only by the lowest class of trade and forever prejudices the discriminating trade against vegetable oil products, if they happen to try using it.

This condition of affairs cannot be changed without a stiff battle, but could be overcome by the Interstate Cottonseed Crushers' Association and the American Oil Chemists Society if they would inaugurate a *real* campaign for co-operation with deeds instead of words. Those who err through ignorance should be assisted, and those who err through greed should be enlightened and shown that the best way is always the cheapest way.

*Extracts from an article in *The Cotton Oil Press*, official organ of Interstate Cottonseed Crushers Association and the American Oil Chemists Society.

Loading Limestone

Bureau of Mines Issues Paper of Interest to All Plants Utilizing Limestone

IN PLANTS which utilize limestone the removal of fragments of broken rock from the quarry floor and the placing of these in cars for transportation to the kilns is a very important process. At most plants of this nature, the loading constitutes the largest single item in quarry cost. In view of the great expense involved, the Bureau of Mines has made an investigation of the subject and has published the results of this investigation in a paper entitled (Serial 2446) "Rock Loading at Lime-Plant Quarries."

Hand Loading

Hand loading is prevalent at most lime quarries today, and this method has numerous advantages. The greatest of these advantages, which applies particularly to the small operator, is the necessity involved with a mechanical-loading system for the investment of a large amount of capital, against which the hand-loading system involves very little outlay. Another advantage of the hand system is that a certain amount of sorting of the material occurs as it is loaded by hand. In addition, by hand loading the fines are sorted out to the maximum amount in the first place, so that only large lumps are shipped to the kiln. A final advantage of the hand-loading system is that it eliminates the possibility of breakdown inherent in all mechanical systems.

This hand-loading method, however, has many disadvantages, two of which only need be mentioned. The first is the fact that with the hand-loading system a much larger gang of laborers is necessary and all the troubles which follow on the employment of a large quantity of unskilled labor will attend the operation. The second disadvantage is the fact that the removal of waste and dirt will lag behind the removal of good stone inevitably where the hand-loading system is used, so that extra labor must be employed to remove this waste in proportion to that used for the limestone, and it will be found that the cost runs 2 or 3 cents per ton greater for handling the waste than for handling the good stone. This is not the case with the mechanical method.

Loading With a Steam Shovel

A steam shovel is used in loading limestone in connection with a crushing and scraping equipment, all of which involves a rather high first cost. The extent of the operation should govern the size of the shovel used —for an output of 150 to 300 tons of rock per day the small tractor shovels with ¾ to 1¼-yd. dippers are suitable. The size of the shovel should be increased from there on in accordance to the size of the operation.

A steam shovel has numerous advantages over the hand method of loading. In the first place, it can handle much larger sizes of material, doing away with a great deal of secondary blasting. Second, a great reduction is made in the size of the labor gang necessary. The Bureau of Mines figures show that one man in a hand shovel gang can load only about one-seventh of the material that a man can load with a steam shovel gang. This is, in fact, the principal advantage of the steam shovel and one that can hardly be overestimated.

The first and main disadvantage of the steam shovel method is the fact that it entails the addition of crushing and sorting material, which is quite expensive. A second disadvantage is the fact that it is hard to make any differentiation in quality of the material loaded, as the steam shovel will load any undesirable material just the same as the good rock. This tends to degrade the final product.

In view of the extra cost involved in the use of a steam shovel, for small plants it is sometimes not well to go into these methods, but it is more economical to retain the hand-loading method.

Mineral Production in Canada in 1922

Canada's mineral production in 1922 was valued at $183,000,000—an increase of $11,106,000 over the value recorded in the preceding year, according to a report issued by the Dominion Bureau of Statistics. This amount was made up as follows: Metallics, $61,000,000; non-metallics, $82,500,000; structural materials and clay products, $39,300,000.

The outstanding feature of the metal production was the large increase in gold in both Ontario and British Columbia, amounting to more than 1,230,985 oz. This represents an increase of 31.0 per cent over 1921. Although nickel and copper were lower last year than in 1921, silver and lead increased appreciably both in quantity and value. The end of the year also saw a marked revival in zinc and cobalt. Metals as a whole advanced 23.9 per cent, to a total value of $61,144,990, as compared with $49,343,232 in 1921.

The slight decline in the production of non-metallics, including coal, amounted to approximately $5,260,343 in value. Since the greater part of this decrease was due to loss of production, caused by labor troubles, it may be regarded as negligible. In the successful marketing of structural materials and clay products, the revival of the building industry has played an important part and during the past year production increased.

The output of natural gas from Canadian fields in 1922 amounted to about 14,954,097,000 cu.ft., valued at $5,468,963. The quantity of gas produced was more than 800,000,000 cu.ft. above the output in the preceding year, and the value in 1922 was about $874,799 more.

The output of asbestos in 1922 reached a total of approximately 136,657 tons of all grades, valued at $4,664,106, as compared with 92,761 tons, valued at $4,906,230 in 1921. The appreciable percentage increase in production was due almost entirely to the activity about the mines during the closing months of the year.

The recovery in mineral production as a whole to a total value of $183,029,595 may be considered most propitious. Comparison with preceding years shows that 1920, 1919 and 1917 were the only years in which this valuation was exceeded.

Factors Affecting Contraction of Alloys

The United States Bureau of Mines lists the following as the most important factors affecting the contraction of a non-ferrous alloy on casting: (1) Chemical composition of the alloy; (2) pouring temperature; (3) cross-section of the bar poured; (4) length of the bar in relation to its cross-section; (5) character of the mold, and the method of molding; (6) gas occlusion, and overheating of the melt. These factors are discussed briefly in Serial 2410, "Contraction and Shrinkage of Non-Ferrous Alloys as Related to Casting Practice," which may be obtained from the Bureau of Mines, Washington, D. C.

The Determination of the Specific Gravity of Coke

Method for Finding Real and Apparent Specific Gravities of Coke and From These Values the Percentage Porosity

By W. A. Selvig and W. L. Parker
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THE percentage by volume of cell-space of lump coke is usually referred to as porosity. In practice, this is calculated from the true specific gravity of the moisture-free pulverized coke and the apparent specific gravity of the moisture-free lump coke, as follows:

$$\textit{Percentage by volume of coke substance} = 100 \times \frac{\textit{Apparent specific gravity}}{\textit{True specific gravity}}$$

$$\textit{Percentage by volume of cell-space} = 100 - \textit{percentage by volume of coke substance}$$

The experiments here described were undertaken in order to develop a satisfactory method for determining true and apparent specific gravities of metallurgical coke. The methods used by various laboratories for making such determinations differ considerably, and results obtained on the same sample may vary decidedly depending on the methods used.

True Specific Gravity

The true specific gravity is, as a rule, determined by boiling the pulverized coke in a liquid, usually water, in an accurately calibrated pycnometer, so as to wet the coke particles thoroughly and displace included gases.

Experiments were made as to the effects of fineness of grinding, the medium used, and the time and method of boiling. The pycnometer used was the Hogarth specific gravity bottle, which usually has a capacity of 100 to 125 cc. and is convenient to manipulate. Each bottle was accurately calibrated, and a table was constructed giving capacities in grams of water at a range of room temperatures likely to exist in the laboratory. The true specific gravity was calculated by the use of the following formula:

$$\textit{True specific gravity} = \frac{W}{W - (W^1 - P)}$$

when W = weight in grams of dry coke
W^1 = weight in grams of pycnometer + coke + water
P = weight in grams of pycnometer + water.

Effect of Time of Boiling and Partial Vacuum

Two samples of metallurgical coke, pulverized in ball mills to pass a 60-mesh sieve, were selected. One was a 72-hour beehive foundry coke, Connellsville, Pa., region; and the other was a byproduct coke from Franklin County, Ill., coal.

Ten grams of moisture-free coke was boiled in water at atmospheric pressure for periods ranging from ½ to 3 hours; other samples were boiled at atmospheric pressure for a half-hour, and the boiling continued for another half-hour under the partial vacuum of a Chapman water filter pump; while samples were also boiled on a water bath under partial vacuum for 3 hours. The results of these tests are given in Table I.

It will be noted from the table that the same results were obtained by boiling at atmospheric pressure for ½- or 1-hour periods as by boiling for 3 hours; also, no noticeable difference resulted when the boiling was performed under a partial vacuum. These results indicate that boiling the pulverized coke for 1 hour at atmospheric pressure is as satisfactory as boiling for longer periods or boiling under a partial vacuum.

Effect of Fineness of Sample and Liquid Medium

Two samples of byproduct coke, one of beehive coke and one of low-temperature coke made in the laboratory at a temperature of 500 to 600 deg. C., were pulverized in ball mills until one portion passed a 60-mesh sieve and another portion a 200-mesh sieve. Specific gravity determinations were made on the 60- and 200-mesh samples, using both water and benzene as mediums. The specific gravity determinations in water were made by boiling for 1 hour at atmospheric pressure, and

TABLE I—EFFECT OF TIME AND METHOD OF BOILING 60-MESH COKE IN WATER

Time and Method of Boiling	True Specific Gravity	
	72-Hr. Beehive Foundry Coke, Connellsville Region	Byproduct Coke From Illinois Coal
½ hour at atmospheric pressure	1.976	1.895
	1.969	1.893
		1.886
	Average 1.97	1.880
		1.891
		Average 1.89
1 hour at atmospheric pressure	1.970	1.890
	1.969	1.897
		1.893
	Average 1.97	1.902
		1.897
		Average 1.90
2 hours at atmospheric pressure	1.976	1.903
	1.969	1.901
		1.900
	Average 1.97	1.903
		Average 1.90
3 hours at atmospheric pressure	1.974	1.902
	1.967	1.904
	Average 1.97	Average 1.90
½ hour at atmospheric pressure and ½ hour under partial vacuum of Chapman filter pump	1.962	1.895
	1.964	1.894
	1.974	
	1.965	Average 1.90
	Average 1.97	
Boiling 3 hours under vacuum of Chapman filter pump	1.969	1.899
	Average 1.97	Average 1.90

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TABLE II—TRUE SPECIFIC GRAVITY TESTS ON 60-MESH AND 200-MESH SAMPLES OF VARIOUS COKES IN WATER AND BENZENE

Origin of Coke	True Specific Gravity	
	60-Mesh (Ash in dry coke, 8.6 per cent)	200-Mesh (Ash in dry coke, 8.8 per cent)
	Water / Benzene	Water / Benzene
Connellsville 72-hr. beehive foundry coke	1.933 / 1.958 1.923 / 1.958 1.930	1.958 / 1.964 1.962 / 1.963 1.955
	Average 1.93 / 1.96	Average 1.96 / 1.96
	(Ash in dry coke, 14.0 per cent)	(Ash in dry coke, 14.1 per cent)
Byproduct coke from Illinois coal	Water / Benzene	Water / Benzene
	1.851 / 1.793 1.845 / 1.803 1.845	1.920 / 1.806 1.919 / 1.803 1.919
	Average 1.85 / 1.80	Average 1.92 / 1.80
	(Ash in dry coke, 10.6 per cent)	(Ash in dry coke, 10.7 per cent)
Byproduct coke from Pittsburgh bed coal	Water / Benzene	Water / Benzene
	1.860 / 1.832 1.864 / 1.838 1.863	1.882 / 1.842 1.890 / 1.842 1.885
	Average 1.86 / 1.84	Average 1.89 / 1.84
	(Ash in dry coke, 4.0 per cent)	(Ash in dry coke, 4.1 per cent)
Low-temperature coke (500-600°C.) from Pittsburgh bed coal	Water / Benzene	Water / Benzene
	1.517 / 1.469 1.524 / 1.468 1.520	1.525 / 1.550 1.528 / 1.554 1.526
	Average 1.52 / 1.47	Average 1.53 / 1.55

those in benzene by boiling a half-hour at atmospheric pressure. Ash was determined on the 60- and 200-mesh portions in order to ascertain whether any increase of ash resulted from the longer grinding required to pass the coke through 200-mesh sieves. The results of these tests are given in Table II. Sizing tests made on the through 60-mesh samples of the four cokes to determine the approximate fineness of the samples showed:

Mesh	Connellsville 72-Hr. Beehive Foundry Coke, Per Cent	Byproduct Coke From Illinois Coal, Per Cent	Byproduct Coke From Pittsburgh Bed Coal, Per Cent	Low-Temperatur Coke From Pittsburgh Bed Coal, Per Cent
On 100	34.9	1.6	23.7	24.2
Through 100, on 200	36.3	50.2	41.8	44.0
Through 200	28.8	48.2	34.5	31.8

It is noted from Table II that there is considerable difference between the results obtained with water and those with benzene. In most determinations benzene gave lower values than water, but in some the reverse was true. With benzene all of the metallurgical cokes gave the same results on 60- or 200-mesh samples; however, for the low-temperature laboratory coke, the 200-mesh sample gave the higher specific gravity. With water, all of the cokes gave a higher specific gravity on the 200-mesh samples, the greatest difference being for the byproduct coke from Illinois coal, where it was higher by 0.07 than for the 60-mesh material. The slight increase in ash content of the 200-mesh material, due to longer grinding, was so small that it did not affect the specific gravity of the samples.

Rose[1] made similar true specific gravity tests on a number of cokes, using water and benzene as mediums, and found in each test that the results obtained with benzene were lower than those with water, these differences ranging from 0.025 to 0.150. He also determined the specific gravities in benzene of portions of a byproduct coke, the one portion being pulverized to pass 60 mesh and the other to pass 200 mesh, and obtained a value higher by 0.06 on the 200-mesh material.

[1] Rose, Harold, J., "The Determination of the True Specific Gravity of Coke," *J. Ind. Eng. Chem.*, vol. 14, No. 11, 1922, pp. 1047-1049.

There is no apparent reason why water should not be used as the medium in determining true specific gravity of pulverized coke. Other mediums may or may not give results comparable to those obtained with water, and benzene evidently will give results differing from those obtained with water.

The higher results obtained with water on the 200-mesh material, as compared with those obtained on the 60-mesh material indicate that it is desirable to pulverize the coke to pass a 200-mesh sieve for true specific gravity determinations. The greatest difference observed was in the byproduct coke from Illinois coal, where a value of 1.85 was obtained on the 60-mesh material, compared to 1.92 on the 200-mesh material. Assuming an apparent specific gravity of 0.90, this difference would amount to 2 per cent in calculating the percentage by volume of cell-space in the lump coke.

Method for True Specific Gravity

Hogarth's specific gravity bottle with a side tubulure is a convenient type of pycnometer for the determination. This bottle as furnished usually has a capacity of about 125 cc. The bottle should be accurately calibrated, and a table constructed giving its contents in grams of water at room temperature likely to occur in the laboratory. This is readily done from tables prepared by the Bureau of Standards[2] giving corrections for determining the true capacities of glass vessels from the weight of water in air.

A 10-gram portion (W) of 200-mesh coke, which has previously been dried for an hour at 105 deg. C., is carefully introduced into the weighed specific gravity bottle with enough distilled water to fill it about half full. It is then placed on a hot plate, and kept boiling for an hour, with frequent shakings to wash down any coke adhering to the sides. It is then removed from the hot plate, filled to the tubulure with recently boiled and cooled distilled water, the stopper inserted, and permitted to cool to room temperature. (Cooling may be hastened by placing the bottle in water.) Next, the bottle is filled to slightly above the mark on the capillary of the stopper. This is conveniently done by inserting the end of the tubulure in a small beaker of previously boiled distilled water, which has been cooled to room temperature, and applying a slight suction on the stopper. The water level is adjusted to the mark on the capillary by touching a piece of filter paper to the end of the tubulure. The bottle is then wiped dry and weighed (W^1). Immediately after weighing, the stopper is removed, and the temperature of the contents taken. The capacity of the bottle in grams of water at the temperature recorded is obtained by reference to the calibration table of the bottle (P).

The true specific gravity is conveniently calculated by the following formula:

$$\textit{True specific gravity} = \frac{W}{W - (W^1 - P)}$$

in which

W = Weight in grams of dry coke.

W^1 = Weight in grams of bottle + dry coke + water to fill.

P = Weight in grams of bottle + water to fill.

Apparent Specific Gravity of Lump Coke

The apparent specific gravity of lump coke is determined in practice by immersing the coke pieces in water, and determining the amount of water displaced.

[2] "Standard Density and Volumetric Tables," Bureau of Standards Circular 19, 1916, pp. 52-56.

As lump coke is a cellular substance, considerable water may penetrate into the coke pieces, so some experiments were made as to the amount of this, and attempts were made to determine the apparent specific gravity by preventing any water from entering during the determination.

The apparent specific gravity tests were made with a Nicholson hydrometer, which instrument permits weighing the sample in air and also when totally immersed in water. The capacity of the hydrometer used was approximately 500 grams of coke. Pieces of coke about 1½ to 2 in. in size were used.

Three byproduct cokes were available for the tests. The samples were dried to constant weight at a temperature of approximately 150 deg. C. previous to making the determinations. About 500-gram samples were taken and weighed in air, after which they were immersed in water for about 3 minutes, and the weight of the sample in water determined. The coke pieces were then removed from the water and allowed to drain for about 1 minute, and then were weighed in air again to determine the weight of water absorbed. The same pieces of coke were then re-dried to constant weight at 150 deg. C., and coated by painting with melted paraffine. Apparent specific gravity determinations were made on the paraffined coke pieces, and a correction was made for the coating of paraffine—the results thus obtained were regarded as the correct apparent specific gravity of the coke.

After immersion of the paraffined pieces, all surface water adhering to the paraffine was removed by absorbent paper, and the pieces were weighed in air to determine the amount, if any, of water that might have penetrated into the coke. The apparent specific gravities of the cokes as determined (1) without correcting for absorbed water, (2) correcting for absorbed water, and (3) as determined on the paraffined pieces, are given in Table III.

TABLE III—APPARENT SPECIFIC GRAVITY OF COKES

(1) Not corrected for absorbed water. (2) Corrected for absorbed water, and (3) As determined on paraffined coke.

Condition	Apparent Specific Gravity		
	Coke No. 1 Weight of sample 413 grams	Coke No. 2 Weight of sample 407.5 grams	Coke No. 3 Weight of sample 488 grams
No correction for absorbed water...	1.16	0.98	1.09
Correcting for absorbed water.....	1.03 44 grams water absorbed	0.91 30 grams water absorbed	1.00 39.6 grams water absorbed
Determined on paraffined coke and correction made for paraffine.....	1.05	0.94	1.02
Correcting for water absorbed by paraffined coke.....	1.04 5.5 grams water absorbed	0.93 4 grams water absorbed	1.00 10.8 grams water absorbed

The tests show that considerable water was absorbed by the coke during the 3-minute immersion in water, the amount varying from 7 to 10 per cent of the weight of coke. It is evident that unless a correction is made for the water absorbed, a considerable error will be introduced. The absorption of water by the dry coke proceeds rapidly after immersion. Coke No. 3, after immersion for 3 minutes, was weighed in air and re-immersed for 30 minutes. It was found that 39.6 grams of water was absorbed in 3 minutes and 46.5 grams in 30 minutes; however, when a correction was applied for the water absorbed, the apparent specific gravity was the same (within experimental error), being 1.00 after the 3-minute period and 1.01 after the 30-minute period.

The paraffined pieces of coke absorbed a small amount of water during the 3-minute period of immersion, the amount ranging from 5 to 10 grams. As the paraffined coke pieces were dried with absorbent paper after immersion, this small gain in weight may be accounted for by imperfections in the paraffine coating on the coke pieces, which probably allowed some water to get into them. Assuming that this small amount of water was absorbed, and making the slight corrections for it, the values obtained for apparent specific gravity are in close agreement with those obtained in the usual manner when a correction is made for absorbed water. The maximum difference between the values obtained for the paraffined coke and those for unparaffined coke after correction for absorbed water amounted to only 0.02. It will be noted that if a correction is not made for the large amount of absorbed water when determining apparent specific gravity in the usual manner, the values obtained will be considerably higher than if the correction is applied—the differences in the three cokes listed in the table ranging from 0.07 to 0.13. It is evident that such a correction should be made in any method for apparent specific gravity which permits water to be absorbed by the sample during immersion.

Method for Large Pieces of Coke

The cell structure of coke pieces from the same oven or retort usually shows noticeable variation, and the cell structure of the same piece of coke may vary at different points of the piece. If a small sample of coke is used for apparent specific gravity determinations, it is essential to select the sample carefully so as to be representative of the coke. The Nicholson hydrometer used in the tests described had a capacity of about 500 grams. By careful selection of the portions for duplicate tests, good checks on duplicate determinations can be obtained with the Nicholson hydrometer method. The sample should be in the form of pieces about 1½ to 2 in. in size, and the pieces used for the tests must be systematically selected. Of 170 different cokes on which duplicate apparent specific gravity determinations were made, the average difference between duplicate determinations was 0.03.

A method by which a large sample of large pieces could be used would be desirable, as it would be easier to select a representative sample. Such a method has been used by the Koppers Co., and the method is one of those for the apparent specific gravity of coke adopted by the American Gas Association.[3] The method is as follows: Select 25 to 30 lb. of coke, which should be as nearly representative as possible of the entire quantity under consideration with regard to size, shape and general appearance. Dry the coke thoroughly at 105 to 200 deg. C., and weigh when cool after shaking and brushing off any adhering dust (*A*).

Provide a wash-boiler or other suitable container with a spout, which may be conveniently formed by soldering in horizontally a short ½-in. nipple about 2½ in. below the top of boiler. The boiler should be placed on a level and rigid base or floor. A wire cage or basket provided with a cover and a long wire handle suitable for holding the entire sample of coke should also be provided and placed in the boiler.

Place a tightly fitting cork in the ½-in. nipple and fill boiler with water until the water level is above the nipple. Allow the water to come to rest, remove cork,

[3] "Gas Chemists' Hand Book," American Gas Assn., 1922 edition, pp. 58-59.

permit all excess water to drain, and replace cork. Remove cage, shaking all adhering water back into the boiler and place the dried coke sample in the cage. Lower the cage and coke into the water and let stand for 30 minutes, with occasional stirring of coke to detach any air bubbles adhering to the surface of the coke, but without disturbing the position of the boiler. The coke must be completely submerged at all times. At the end of the 30 minutes, after the water has come to rest, remove cork and allow the displaced water to drain into a weighed container. Weigh the displaced water (B). Quickly remove the cage and coke from the water, allow to drain for 1 minute and weigh wet coke without cage (C).

A = Weight of dry coke.
B = Weight of water displaced by wet coke.
C = Weight of wet coke.
$C-A$ = Weight of water absorbed by coke.
$B + (C-A)$ = Weight of total water displaced and absorbed.
$\frac{A}{B + (C-A)}$ = Apparent specific gravity.

(Note: The water should be near room temperature so as not to vary appreciably.)

Results of This Method

As will be noted, the above method uses a large sample of coke, and makes a correction for water absorbed by the coke during immersion, which, according to the experiments previously described in this paper, should give fairly correct values for the apparent specific gravity of coke.

In order to test the accuracy of the method, tests were made on two different byproduct cokes which were available in sufficient quantity to obtain approximately 18 lb. of large-size pieces. A wash-boiler was used as the water container. The coke pieces were dried to constant weight at about 150 deg. C. before the determinations. The same pieces of coke were used throughout the tests, all water being removed before each determination by drying to constant weight. The results of these check determinations are given below:

Apparent Specific Gravity Check Results as Determined on Same Pieces of Coke by Method Using Large Sample

Coke No. 1 (8400-gram sample)	Coke No. 2 (8050-gram sample)
0.91	1.05
0.90	1.04
0.90	
Average 0.90	Average 1.05

The results show that the method itself is accurate inasmuch as, obtaining close checks, the greatest difference shown was only 0.01.

It was found, when the cork was removed from the overflow spout in order to allow the water in the wash-boiler to come to a constant level, that water would drip from the spout for a long time. Satisfactory results were obtained by allowing the water to drip for 1 minute after the overflow stream started to discharge drop by drop.

Conclusions

For calculating the percentage by volume of cell-space of metallurgical coke, the following conclusions are drawn from the tests on methods of determining true and apparent specific gravities:

1. True specific gravity may be satisfactorily determined by boiling the pulverized coke in water at atmospheric pressure for 1 hour in a convenient calibrated pycnometer such as the Hogarth specific gravity bottle.

2. The experiments indicate that it is not necessary to boil the sample under reduced pressure, or to boil at atmospheric pressure for periods longer than 1 hour.

3. Somewhat higher results were obtained for true specific gravity on coke samples pulverized to pass a 200-mesh sieve as compared to the same samples pulverized to pass a 60-mesh, so it appears to be desirable to pulverize the coke to pass a 200-mesh sieve.

4. It is not advisable to use other mediums besides water for determining true specific gravity of coke, as the results may not be comparable. In the case of benzene, the results obtained did not check those obtained with water, and benzene appears to have a tendency to give lower values than those obtained with water as a medium.

5. In determining the apparent specific gravity of lump coke, a correction should be applied for water absorbed, as metallurgical coke is a cellular substance which absorbs considerable water rapidly after immersion.

6. The method for determining apparent specific gravity, using a sample of 20 to 30 lb. of large pieces of coke, and correcting for the water absorbed, is recommended.

The writers are indebted to A. C. Fieldner, supervising chemist, Pittsburgh Experiment Station, U. S. Bureau of Mines, for helpful suggestions.

Investigation of Mineral Fillers

At the Southern experiment station of the Bureau of Mines, Tuscaloosa, Ala., a special study is being made of the determination of the grain size and character of grains of representative fillers produced in the district. This investigation of non-metallic minerals is for the purpose of determining their use as mineral fillers. It includes a study of the various methods of calculation of average grain size applicable to fillers which vary greatly in size—from diameters of 100 microns or more to zero—and the determination of average grain size of representative samples of commercial fillers, including clay, barite, fullers earth, whiting, mica, ocher, slate, silica and talc. The character and size of particle of fillers is a basic property which has an important effect on the other physical properties and characteristics.

A study of the effect of grain size of fillers in compounding is also being undertaken and will be conducted along the line of determining the difference in actual use between a filler made up of mixed sized grains as usually employed, and the same material classified within as close limits as possible regarding variation in grain size and having the same average diameters as the mixed product. It will also include the determination of the difference in effect between two products of the same material but classified between different limits of grain size.

The effect of heat-treatment on the properties of non-metallic minerals other than clays with respect to their use as fillers is also being studied by the Bureau of Mines. This will involve a determination of the effect of heating at different temperatures on the specific gravity, loss in weight, color, grain size, oil absorption, covering power or spread and ease of grinding. Previous work on clays along the same line has shown an improvement of certain samples for filler use.

The relationship among grain size, oil absorption and covering power of fillers and pigments is also being investigated. The general direction of this relationship is known, but no exact data are available on the subject.

Effect of Ammonia on Steel

In co-operation with the Fixed Nitrogen Research Laboratory, the Bureau of Standards has made a microscopic examination of specimens representing a series of steels varying in carbon content from 0.02 to 0.98 per cent exposed to a current of ammonia at temperatures in the range of 100 to 700 deg. C. The purpose of this test was to determine the effect of change in carbon content upon the method of attack of heated ammonia. No change was observed on the specimens up to 400 deg. C.; at 500 deg. a film of white nitride was followed by the layer of nitride needles. At 600 deg. C. this effect increased, while at 700 deg. a new compound of nitrogen was formed following directly the film of white nitride layer. At 700 deg. C. the nitride needles in low-carbon steels removed further from the edge to the center. They are absent at that temperature in high-carbon steels of 0.49 to 0.98 per cent C.

Testing a Cost System

The rules to apply in analyzing the soundness of a cost system are:

Does your cost system give you up-to-date costs, not merely history?
Does it aid in stablizing your wages and piece-work rates?
Does it point out defects in your routing system?
Does it help you maintain a perpetual inventory?
Does it increase your production?
Does it measure your overhead?
Does it detect new overhead expense?
Does it point out leaks in expense?
Does it encourage your employees?
Does it promote intelligent competition?
Does it point to non-profit paying lines?
Does it permit you to bid safely?

Twelve suggestions for testing the value of a cost accounting system are given in a pamphlet issued recently by the fabricated production department of the Chamber of Commerce of the United States.

A cost accounting system is very much like the engine of an automobile, only there are more various kinds of cost systems and their idiosyncracies are legion. If a cost system fails to show what it should, it consumes profits. It pays to check your system; you ought to determine the upkeep and make sure it pays.

Wear Tests on Steels

Some investigations on the wear of steel have been under way at the Bureau of Standards, in connection with the work sponsored by the Gage Steel Committee. Especial effort has recently been made to keep the surfaces of the specimens clean and free from all adhering abraded particles while under test. A cloth buffing wheel, rotated at high speed by electric motor, has been used successfully for this purpose. It has been found that when the wearing surfaces are thus kept free of abraded metallic dust, the rate of wear drops to a comparatively almost negligible quantity.

Record Sugar Crop in Hawaii

Hawaii's sugar cane harvest during the year ended last Sept. 30 was the largest in 8 years, according to an estimate by the Department of Agriculture. Production for the year was placed at 1,184,000,000 lb., or 13 per cent more than that for the previous year

A New Instrument for Testing Glue and Gelatin Jellies

Description of Bloom Gelometer Developed for Factory Control Work, but Useful for Other Jelly Strength Investigations

By William D. Richardson
Chief Chemist, Swift & Co., Chicago

THE jelly strength of glue and gelatin may be considered the most important single determination which it is customary to make on these important substances. Following the old finger test method, which is still in use in many factories in this country and abroad, numerous mechanical devices have been developed for the purpose, all of more or less merit. A description of these is scattered through the literature, and a summary of a number of types, including those of Peter Cooper, Lipowitz, Valenta, Scott, Alexander, E. S. Smith, Forest Products Laboratory, Hulbert, C. R. Smith, Sheppard and Schweitzer, are included in Bogue's[1] recent work on gelatin and glue. In addition to these a number of other types are in use in the laboratories of different glue factories.

The outstanding feature of all previous testing machines for jelly strength is that they have not been standardized and reproducible. Each has been a law unto itself capable of developing comparable results, which were intelligible to the user in terms of certain glue and gelatin standards, the standards being carefuly preserved from month to month and year to year for making comparisons with factory runs and shipments of product. Standards of this sort, however, ultimately became exhausted and when new standards were selected they were probably not identical with the old.

The fundamental idea underlying the development of the Bloom Gelometer, named after O. T. Bloom, its inventor, was that of a machine so constructed that it could be reproduced by measurement and, given precisely regulated conditions, would yield identical results at any time and place on the same sample. It should be understood, however, that due caution be observed in applying the term "precisely regulated conditions," particularly as regards the temperature of the jelly, which must be most carefully controlled and regulated for a definite period of time prior to the test by means of a thermostat bath.

General Description

This instrument is so designed that the two factors, diameter of plunger and depth of plunge, are maintained constant, and the third factor, time of application of the pressure, which is applied by means of flowing shot, is kept within a reasonably close time limit. While the depth of plunge can be varied, it is kept precisely at 4 mm. for the purpose of testing glue and gelatin jellies, while the time of introduction of the shot is maintained between 2 and 5 seconds. The diameter of the plunger is exactly 12.7 mm. (½ in.) and is constructed of aluminum or hard rubber, the sharp lower edge being rounded to the slightest possible degree to prevent cutting.

The instrument is automatic in its action. Once started by hand, the flow of shot is rapid and continuous between the two contact points, and the cut-off is sharp

[1] "The Chemistry and Technology of Gelatin and Glue," by Robert H. Bogue, Mellon Institute Technochemical Series, McGraw-Hill Book Co., Inc., pp. 369 to 380 (1922).

when the silver disk working between the two contact points reaches the lower point. It has been found in the comparatively brief time that the instrument has been operated that it yields excellent results, accurate beyond the requirements of factory or trade.

In reading the following description and working directions for the instrument, reference should be had to Fig. 1.

The instrument is mounted on the base R_1 and the pillar R_2. The adjustment stand N resting on the base R_1 is provided with a platform N_1 capable of being raised and lowered by the rack and pinion mechanism N_2. Affixed to the upper end of the pillar R_2 by the bracket J_1, the spring adjusting mechanism G holds the spring F and the plunger L, hanger and pan H_1 and H_2 respectively. At the upper part of the plunger hanger, the silver contact disk B is set to operate between the contact points A_1 and A_2. The rod H_3 of the plunger hanger works through the adjustable guide J_{1a} which is affixed to the bracket J_2.

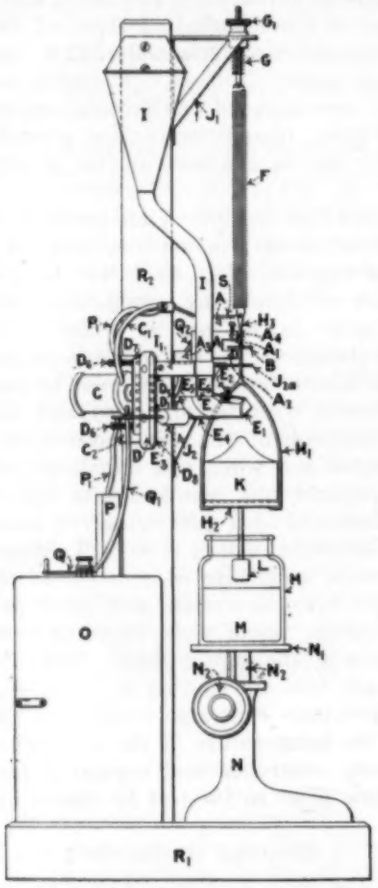


FIG. 1—BLOOM GELOMETER FOR TESTING GLUE AND GELATIN

Affixed to the upper end of the pillar also is the shot hopper I, supplying shot through the clamshell cut-off E-E_1 to the shot receiver K, which rests on the pan H_2. The automatic shot control mechanism D-D_7, working on the clamshell cut-off E-E_1 consists of the electromagnet C, the soft iron bar D_7 carrying the brass dogs D_1 to D_5 and the brass guide bar D.

The cut-off mechanism consists of the clamshell cut-off E-E_1, the control rod E_4, working on the dogs D_1-D_5 and the counterbalance weight E_5. E_6 is the bearing on which the cut-off mechanism turns. The entire cut-off mechanism is adjustable vertically on the pillar R_2 by means of the screws C_2, this adjustment setting and adjusting the pitch of the clamshell cut-off E-E_1. This adjustment is made when the machine is assembled and is permanent.

Electric current is supplied to the electromagnet C through the contact points A_1-A_2 from the 3-volt dry battery O through the connections Q_1, C_1, S and Q_2. P is a small telephone condenser arranged in shunt circuit by means of the connections P_1 and P_2.

The test bottle M containing the jelly to be tested rests on the platform N_1.

The space between contact points A_1 and A_2 is adjusted as follows: With the current cut off by means of switch Q and with the silver disk B resting on contact point A_2, adjustment is made by means of the adjustment screw A_3 so that the distance between the upper face of the silver disk B and the contact point A_1 is exactly determined. This determines the depth of plunge. In the case of glue and gelatin jellies, the depth of plunge is exactly 4 mm. as determined by the standard Brown & Sharpe 4-mm. gage furnished with the instrument.

Adjustment is now made of the silver disk B against contact point A_2 by turning the adjustment screw G_1 (which acts on the spring F) until the silver disk B is in lightest possible contact with contact point A_2. When this point is reached, sparking will be noticed between the point A_2 and the disk B and a make-and-break vibration is set up between the soft iron bar D_7 and the core of the electromagnet C. When this adjustment is once carefully made the machine stays in adjustment for some time, although readjustment should be made occasionally.

The glue or gelatin jelly (or the like), prepared in the usual way or according to standard directions, is placed in the test bottle M and chilled to the test temperature for the desired length of time. The bottle is placed on platform N_1 and raised by means of the rack and pinion mechanism N_2 until the jelly is in contact with the plunger L and the latter is raised until the silver disk B is brought into light electrical contact with contact point A_1. This point is indicated by sparking and make-and-break vibration between the soft iron bar D_7 and the core of the electromagnet C. The shot receiver K is quickly placed on pan H_2 and immediately the lever E_4 is raised to the predetermined position on one of the dogs D_1-D_5. The height to which lever E_4 is raised regulates the velocity of the flow of shot. For weak jellies one of the lower dogs is used, for strong jellies one of the upper dogs. The dog selected should be such as to keep the flow of shot within the prescribed limit of 2 to 5 seconds. The finest chilled shot obtainable is used, No. 12 or finer. The raising of the lever E_4 immediately starts the flow of shot, depressing the plunger L into the jelly until contact is made between the silver disk B and contact point A_2. This closes the circuit which acts on the electromagnet C, moving the soft iron bar D_7 and withdrawing the support of the dog from the lever arm E_4, which immediately falls, thus cutting off the flow of shot by closing the clamshell cut-off E-E_1.

The weight of shot delivered into the shot receiver K plus the weight of the shot receiver itself is the weight required to move the plunger L through the prescribed distance against the resistance of the jelly, and measures the jelly strength. For glues and gelatins this distance is exactly 4 mm. as determined by a Brown & Sharpe gage.

After the combined weight is determined, the shot is emptied back into hopper I and the machine is ready for another test.

The Bloom Gelometer is sufficiently accurate for all control work in glue and gelatin factories and is, in fact, rather more sensitive than previous devices for the same purpose. It can also be applied to the investigation of jellies for scientific purposes and for the determination of the influence of various factors on the strength of jellies, such as concentration, p_H value, time of setting, time of pressure application, etc. It should be used in conjunction with a thermostat bath capable of being regulated to within 1/10 of 1 deg. C. at 10 deg. C., and by preference test should be made in a chill room the temperature of which is carefully controlled at 10 deg. C.

Columnar Crystallization in Ingots of Invar

The Bureau of Standards has studied the ingot structure of ingots of invar (Fe:Ni 65:35) and the relation of the structure to the forgeability of the alloy. It has been found that ingots cast in chilled molds cool too slowly and form excessively large columnar crystals, producing a very brittle ingot which breaks readily on forging. To correct this difficulty a specially designed and refrigerated mold must probably be used.

Synopsis of Recent Chemical & Metallurgical Literature

Ingot Practice for Chromium Steels

In order to find the effect of the rate of solidification on the eutectic network, P. Oberhoffer[1] made six series of chromium steels with carbon varying from 0.65 to 1.50 per cent and chromium from 1.8 to 13.5 per cent. In every series, consisting of two charges each, one was chill cast and the other allowed to cool down with the ladle. On macro-etching, the latter showed a dendritic structure and the former a fine globular structure. On "secondary" etching with a concentrated solution of picric acid in alcohol containing a few drops of nitric acid, the slowly cooled steels showed a large network and chill-cast steels a fine network. Test pieces were then forged down from 45 mm. square to 15 mm. square. On microscopic examination the slowly cooled steels showed long drawn out accumulations of carbide particles, while in the quickly cooled steels the carbides were distributed quite evenly throughout the sections. Mechanical tests indicated that the notch toughness was higher in chill-cast specimens—otherwise the results were quite similar.

[1]*Stahl und Eisen*, 1922, vol. 42, pp. 1240-1242.

Composition of Blast-Furnace Gases

The composition of blast-furnace gas is definite enough to be expressed by a linear formula, as pointed out by M. J. Seigle in *Revue de Métallurgie*, 1922, vol. 19, pp. 11-36. If the respective percentages of nitrogen, oxygen, carbon dioxide, carbon monoxide, hydrogen, water (vapor) and methane are a, b, c, d, e, f and g, so that $a + b + c + d + e + f + g = 100$, then $4.76b + (4.76 - N)c + (2.88 - N)d + 0.88e + f + g = 100$. If the amounts of oxygen (b), of hydrogen (e) and of methane (g) can be left out, then for a dry blast

$$(4.76 - N)c + (2.88 - N)d = 100.$$

In this formula N is a function of the volume of carbon dioxide introduced by the carbonates from the flux (λ), of the volume of oxygen from the oxides in the ore (μ) and of the percentage a of carbon contained in the pig iron, whose total weight is F.

$$N = \frac{\lambda + \mu}{0.495\ (1 - \frac{aF}{100} + 0.54\lambda)}$$

It follows from these formulas that the possible values for the volumes c and d of carbon dioxide and carbon monoxide will lie on certain straight lines. These lines are not parallel and the points where they intersect the axes c and d are easily calculated.

Applying these formulas to the extreme case of that of a gas producer, we have $4.76c + 2.88d = 100$.

On the other side, for an electric blast furnace we have the simple equation $a + b = 100$.

This latter line shows the limit for the possible numerical values of CO_2 and CO. Thus a graphical representation of the composition of blast-furnace gases is conveniently drawn and various theoretical and practical conclusions easily arrived at. Most important is the possibility of predicting the various occurrences which would happen when any changes are introduced in the conditions existing in the blast furnace.

Fuel Oils in Internal Combustion Engines

There are three distinct types of difficulties encountered in the burning of heavy oils—namely, ignition, burning after ignition, and impurities. Even an oil that meets two of these requirements is often found unfit for use on account of the third effect. Harold Moore, in a paper which is presented in abstract form in the *Journal of the Franklin Institute* for February, 1923, classifies heavy oil engines in the three groups: Diesel engines using compressed air for firing; cold starting engines which fire by spontaneous combustion, the fuel being pulverized without air blasts; and hot bulb engines in which the fuel is injected mechanically, external heat being applied to insure ignition. The capacity of an engine for burning heavy fuels is not merely dependent upon the cycle and the method of fuel injection; it is also determined to a very marked degree upon the size, speed, compression, fuel-valve tuning and other factors.

Fatigue of Metals

To find out (1) whether a safe "endurance limit" does really exist and (2), what is happening to a metal subjected to alternating stresses, investigations were undertaken by Professor Ludwick[1] at the Technical College in Vienna. Specimens of aluminum, copper and iron were subjected to series of stresses and the results were plotted as curves, having for co-ordinates the unit stress and the number of cycles. The results indicate that even when the number of repetitions becomes infinite, the unit stress necessary for fracture does not approach zero. This means that an endurance limit is passed by metal and that lesser stresses can be applied to the specimen indefinitely.

It has been further found out that the resistance to alternating impact stresses depends not on the ductility or malleability of the metal, but on its elastic limit, its yield point and hardness—in other words, this resistance is not a function of the faculty of the material to endure deformation, but to withstand deformation. For instance, a quenched specimen, in spite of its brittleness, would show a better resistance under these tests than an annealed one.

Microscopical investigations show how stresses produce slipping along crystal planes inside the crystallites. If stresses are small such slipping usually

[1]Paper read June 29, 1922, before the German Association for the Study of Metals, and abstracted in *V. D. I. Nachrichten*, 1922, No. 28/29a, July 19, pp. 310-311.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

BUILDINGS FROM THE MANAGER'S VIEWPOINT—TYPES OF INDUSTRIAL CONSTRUCTION. G. L. H. Arnold. *Management Engineering*, March, 1923, pp. 177-182.

MANUFACTURE OF SULPHURIC ACID BY THE CONTACT PROCESS. III, Processes and Apparatus for Purifying Gases. H. Braidy. *L'Industrie Chimique*, February, 1923, pp. 54-57.

VERTICAL ACID PUMPS. C. Millberg. *L'Industrie Chimique*, February, 1923, pp. 61-63.

EXTRACTION OF VEGETABLE OILS WITH ACETONE. Louis Périn. *L'Industrie Chimique*. February, 1923, pp. 63-64.

SPECIFIC HEATS OF NITROUS AND NITRIC OXIDES. J. R. Partington and W. G. Shilling. *Phil. Magazine*. March, 1923, pp. 416-430.

PREFERENTIAL OXIDATION IN THE PRESENCE OF CATALYSTS. Rex Furness. *Chemistry and Industry*, March 1923, pp. 196-199.

GASOLINE TEN YEARS HENCE. Ralph H. McKee. *Chemistry and Industry*, March 2, 1923, pp. 193-196.

THE BRITISH INDUSTRIES FAIR. *Chemical Age* (London), Feb. 24, 1923, pp. 195-204.

THE FUTURE OF THE BRITISH COLOR INDUSTRY. Dr. H. H. Hodgson, *Chemical Age* (London), March 3, 1923, pp. 231-232.

THE RATE OF REACTION BETWEEN GASES AND LIQUIDS. H. G. Becker. *Phil. Mag.*, March, 1923, pp. 581-592.

SOME MECHANICAL FEATURES OF THE RUBBER INDUSTRY (First Part). H. C. Young. *The Engineer*, Feb. 23, 1923, pp. 196-197.

STATISTICAL COMPILATION. H. B. Horwitz, H. A. Wembridge and H. J. Hutkin. *Bulletin* of the Taylor Society, February, 1923, pp. 3-11.

THE ORGANIZATION AND MANAGEMENT OF A MEDIUM-SIZED PLANT. Percy S. Brown. *Bulletin* of the Taylor Society, February, 1923, pp. 12-30.

occurs where the metal is less homogeneous—i. e., in the neighborhood of slag enclosures, porosities and impurities. At such places even a certain rise of temperature can be detected, showing that it is there that the metal actually "works"; on the other hand the sound metal would be still subjected to elastic deformations only.

Gas Producers

At a meeting of the Manchester Section of the Society of Chemical Industry, held on Feb. 2, T. R. Wollaston read a paper on "Some Developments in Gas Producers," which was reported in the *Iron and Coal Trades Review* for Feb. 9, 1923.

The results obtained from gas producers of the recovery and non-recovery type are compared with those from an improved plant which has been devised with a view to eliminating as far as possible the faults of the older systems.

Performance

The paper set forth a statement of the average performances of gas producers at the time (10 years ago) when the author began his investigation, and indicated the causes of loss and inefficiency which appeared preventable. These, expressed in B.t.u. and money value and compared with the new plant—the R-G. plant so called—are shown diagrammatically in Fig. 1 and Fig. 2. In Fig. 2 an assumption is made that an ammonia sulphate yield of a gross value of 7s. involves a production cost of 4s.

The R-G Producer

The R-G. experimental plant which gave the records from which these diagrams were made has a 9-ft. diameter producer of 1,300 lb. hourly capacity. The fuel is introduced through a retort in contact with hot exit gases and is thus partly coked, while the gases are enriched. The steam for the process is raised by means of an annular boiler, surrounding the unlined producer body. Blast saturation and superheat are derived from a central cone-shaped boiler within the producer which acts as a flash-boiler.

The author pointed out that the precoking leads to a wide extension of the range of common fuels available, to practical elimination of clinkering, to great ease and economy of working, and to the production of a gas of unusually high value, as for example, CO_2, 10.6 per cent; CO, 18.8 per cent; H_2, 24.4 per cent; CH_4, 3.9 per cent; total combustible, 45.1 per cent; higher heating value, 182.5; lower heating value, 164.5 B.t.u. per cu.ft.

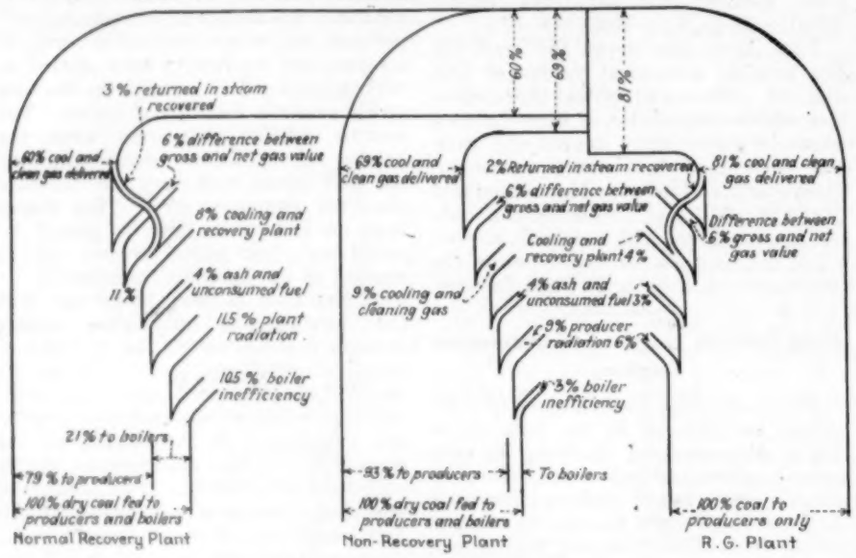


FIG. 1—IN THERMAL UNITS

Loss of Volume and Heating Value of Water Gas Under High Pressure

W. A. Dunkley, gas engineer of the Bureau of Mines, reports in Serial 2,447 of that bureau on an extended investigation to determine the extent to which condensation of moisture and liquid hydrocarbons from carburetted water-gas is the cause of loss of volume or of heating value of the gas. The work was done in connection with the distribution system of the Western United Gas & Electric Co., of Aurora, Ill. That system includes supply of gas over a territory 85 miles long by 35 miles wide at pressure ranging up to 90 lb. per square inch.

This work shows that the condensation of water vapor and of oil vapors in the distribution system does not ordinarily contribute materially to the loss in volume during distribution. Only when the inlet gas is metered at considerably higher temperature and then subsequently compressed and cooled is the volume decreased by as much as 5 per cent due to condensation. The effect on heating value under the conditions of test was a loss of approximately 9 B.t.u. per cubic foot, or 1.6 per cent, but it is believed that this might increase during extreme winter weather to 35 B.t.u., or 6 per cent of the initial heat value under extreme conditions. The full report can be obtained on application to the Bureau of Mines, Washington, D. C.

Silico-thermy and Its Practical Application

The reaction between iron and silicon is one producing a considerable evolution of heat. Therefore when soft iron and metallic silicon are heated together in a crucible to a temperature of about 1,250 deg. C., which is still considerably below the fusing temperature of either of them, a vigorous reaction ensues, the temperature rises rapidly to above 1,800 deg. C., the mass melts, and the whole contents of the crucible become an overheated liquid. If the charge was of about 80 per cent iron and 20 per cent silicon the product would have the composition of the silicide Fe_2Si, if 67 per cent and 33 per cent of FeSi. At intermediate percentages a more or less saturated solution of these silicides in iron is apparently obtained. As alloys so obtained are too brittle for practical use, a certain amount of carbon must be alloyed, whereupon alloys very suitable for making acid-resisting wares are obtained. In describing the process, R. Walter[1] suggests for these alloys the name of "Thermisilid." The valuable properties of "Thermisilid" are obtained because of its homogeneity, which is not attained in other high

[1] A paper read before the German Society of Metals, *Metallkunde*, 1921, pp. 225-233.

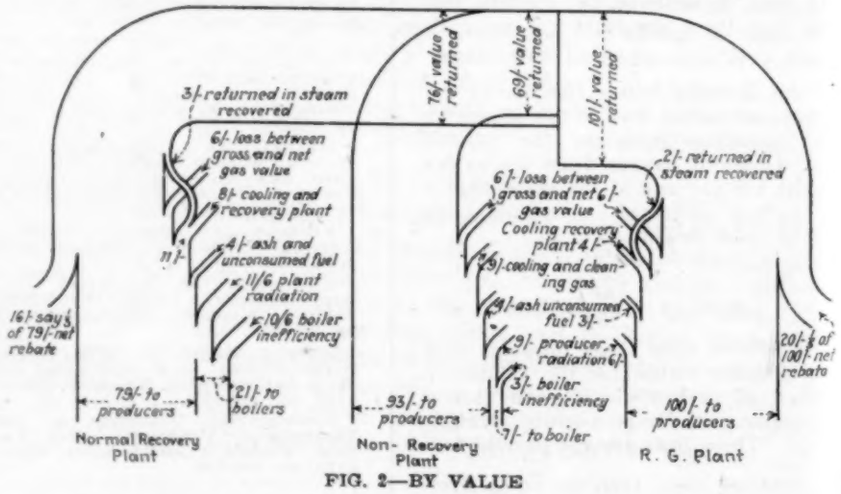


FIG. 2—BY VALUE

silicon irons. Numerous sections are described and the structure of the finished article given as that of polygonal crystals of Fe_2Si imbedded in the matrix of a solid solution of silicon in iron. Carbon is present in the ground mass as evenly distributed fine flakes of graphite.

During the verbal discussions in which, among others, Professors Arndt and Guertler took part, the suggestion was put forward by the latter that a low-melting eutectic might be formed at or about the temperature of 1,250 deg. The formation of the first liquid drop would thus liberate a certain amount of heat and facilitate the liquefaction of further quantities of the charge.

The analogy that exists between alumino-thermy and silico-thermy was also discussed, as well as the possibilities of numerous practical applications for industry.

Buildings From the Manager's Viewpoint

The manager of an industrial organization which is about to construct new buildings has many problems to solve quite outside the usual routine of manufacture. As a guide in the solution of these problems, G. L. H. Arnold has written an interesting article in the March, 1923, issue of *Management Engineering*. This article points out that the questions which arise are inevitable and depend entirely upon the industry for which the buildings are to be erected. Once a decision is reached on any of these problems and the building is erected, it is a fixture. Therefore thought must be taken before any building is started, so that nothing shall be erected which is a hindrance to future operations.

The principal concern of the manager in deciding the type of buildings to erect is with the effect of the new building on his output. In considering this phase of the matter, the following points must be taken account of:

1. Duration of occupancy.
2. Character of occupancy.
3. Extent and character of probable future growth.
4. Advisability of providing space to be rented.
5. Nature of materials used in manufacture.
6. Fire and explosion hazards.
7. Size and weight of units to be handled.
8. Methods of transportation within the building.
9. Class of machinery or equipment to be installed.
10. Receiving, shipping, and storage requirements.
11. Amount and character of departmental intercommunication necessary.
12. Type of labor employed.
13. Density and distribution of population in the neighborhood.
14. Economic arrangement of equipment.

The author goes on to enlarge on these various factors and points out particularly the responsibility of the management in deciding the story height, building width and column spacing carefully with relation to the industrial operations that are to be carried on in the building. In conclusion the paper states that the new building is a machine, each detail of which must be considered with relation to its effect upon the quality, quantity and cost of the product. The governing question as to size and type of industrial building in the last analysis is whether the benefit to the product is sufficient to justify the expense incurred.

Recent Chemical & Metallurgical Patents

Manufacture of Phenyl Glycine—There are several well-known methods for making synthetic indigo which start with aniline as a base, the principal intermediate product being phenyl glycine ($C_6H_5.NHCH_2.CO_2H$). One of the earliest methods developed for making phenyl glycine from aniline was by reaction with chloracetic acid in the proportion of three molecules of aniline to one of the acid. This process has, however, presented considerable difficulties, principally due to the formation of certain undesirable intermediates, such as anilide. These products, of course, affect the yield of phenyl glycine. In a process patented by Charles J. Strosacker, of Midland, Mich., and assigned to the Dow Chemical Co. of that city, the aniline and chloracetic acid are mixed in the presence of water, the water being approximately one part in four by weight of the combined mixture. The mixture is

American Patents Issued March 6, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,447,203—Process of Making Arsenicals. Carleton Ellis and Vernon T. Stewart, Montclair, N. J.

1,447,208—Composition of Matter for Use as a Roof Paint. Joe Power and Henry Wolfe, Sparta, Ill.

1,447,248 — Smokeless-Powder Dynamite. Linwood H. Jones, Kenvil, N. J., assignor to Hercules Powder Co., Wilmington, Del.

1,447,296—Apparatus for the Combined Solvent and Destructive Distillation Treatment of Shale. David T. Day, Washington, D. C.

1,447,297—Process for the Combined Solvent and Destructive Distillation Treatment of Oil Containing Earthy Material. David T. Day, Washington, D. C.

1,447,344—Pulp Washing and Condensing Apparatus. Ira Thomas Fisk, North Hoosick, N. Y., assignor to Stevens & Thompson, Inc., North Hoosick, N. Y.

1,447,400—Process for the Manufacture of Alkaloids. Arthur Stall, Basel, Switzerland, assignor to Chemical Works, formerly Sandoz, Basel, Switzerland.

1,447,401—Apparatus for Producing Smoke. James N. Alsop, Owensboro, Ky., assignor to Packer's Meat Smoking Corporation, Chicago, Ill.

1,447,452—Colloidal Decolorizing Material and Process of Producing the Same. Leonard Wilkenden, Flushing, N. Y.

1,447,461—Method for Employing Decolorizing Carbons and Other Absorbing Materials. Joseph Fergus Brewster, Clarendon, Va., and William G. Raines, Jr., Jackson, Miss., assignors by direct and mesne assignments, to the Government of the United States and to the people of the United States.

1,447,485—Coloring Matters Derived From Pyrazolone. Emil Reber, Basel, Switzerland, assignor to Society of Chemical Industry in Basel, Basel, Switzerland.

1,447,501—Process for the Preparation of Basic Salicylate of Aluminum. Jean Altwegg, Lyon, France, assignor to Société Chimique des Usines du Rhone, Paris, France.

1,447,544. Manufacture of Sodium Phosphate. Walter Glaeser, Brooklyn, N. Y.

1,447,557—Reduction of Nitrocompounds. David Alliston Legg, London, England, assignor to Matthews Atkinson Adam, London, England.

1,447,568—Process of Treating Lime-Containing Materials. Joseph Pelt, Cicero, Ill.

1,447,581—Apparatus for the Combustion of Poisonous Gases in Blast Furnaces. Johann Voegeli, Zurich, Switzerland.

1,447,645—Roasting Sulphur-Bearing Materials, etc. March F. Chase, Cleveland, Ohio, and Frederic E. Pierce and John Skogmark, New York, N. Y., assignors to the Cos Process Co., Inc., New York.

1,447,654—Method of and Apparatus for Drawing Sheet Glass. Arthur E. Fowle, Toledo, Ohio, assignor to the Libbey-Owens Sheet Glass Co., Toledo, Ohio.

1,447,661—Method and Apparatus for Flattening Sheet Glass. Seth B. Henshaw, Charleston, W. Va., assignor to the Libley-Owens Sheet Glass Co., Toledo, Ohio.

1,447,689—Process of Reactivating Spent Catalyzers. William D. Richardson, Chicago, Ill., assignor to Swift & Co., Chicago.

1,447,930—Preparation of Preservative Substances for Rubber Latex. Samuel Cleland Davidson, deceased, late of Belfast, Ireland, by Frederick George McGuire, Bangor, Ireland, Alfred Agar, Holywood, Ireland, and Hugh Taylor Coulter, Belfast, Ireland, executors.

1,447,937—Process of Making Hydrochloric and Arsenic Acids. Carleton Ellis and Vernon T. Stewart, Montclair, N. J.

1,447,938—Process of Making Arsenate of Lime. Carleton Ellis and Vernon T. Stewart, Montclair, N. J.

1,447,954—Oxidizable Oil. Paul Wentworth Webster, Pelham Manor, N. Y., assignor to Perry & Webster, Inc., Elizabeth, N. J.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

then heated to a temperature at which the reaction starts, whereupon the heat is withdrawn and the action is allowed to proceed to completion. The aniline salt of phenylglycine and aniline hydrochloride are formed. Then a suitable neutralizing agent, such as sodium carbonate, is added in amount sufficient to react with the hydrochloride, with the result that it is decomposed into aniline oil and sodium chloride. After the products are allowed to settle and become stratified, the mixture of the aniline salt of phenylglycine and aniline oil is drawn off and treated with a solution of sodium carbonate to yield the sodium salt of phenylglycine and additional aniline oil. The latter is easily separated and returned to the process. (1,442,732. Jan. 16, 1923.)

Method of Making Phthalic Anhydride—Hidematsu Sasa, of Tokyo. Japan, has been granted a patent for the manufacture of phthalic anhydride from nitro-naphthalene. He claims that his product can be manufactured economically with sulphuric acid of ordinary strength and with a cheap metal such as iron or zinc as a catalyst. Other processes based on the oxidation of naphthalene often require the use of fuming acid and mercuric or other expensive salts as catalysts. In the process here described, 450 kg. of sulphuric acid, 65 deg. Bé., is heated to 150-160 deg. C., and then 35 kg. of nitro-naphthalene is added. After the latter has fused into the sulphuric acid, 80-90 kg. of iron borings or zinc dust is added during agitation. A temperature of 200 deg. C. is maintained until all the gases are driven off; then the temperature is raised about 300 deg. C. and phthalic anhydride is driven off and recovered by condensation at the proper subatmospheric pressure. (1,443,094. Jan. 23, 1923.)

Phosphate Fertilizers — Hermann Plauson, of Hamburg, Germany, has patented a process for preparing a satisfactory phosphate manure by simply grinding the insoluble crude phosphate with six times its own weight in water to which a little acid or alkali has been added. The beater mill employed in the process reduces the phosphate to practically a colloidal condition and in this form, after drying, it is claimed to be an excellent fertilizer in spite of the fact that it is regarded as an insoluble form under normal conditions. (1,445,167. Feb. 13, 1923.)

Production of Zinc Oxide—E. P. Stevenson has assigned to Arthur D. Little, Inc., of Cambridge, Mass., a process for making pure zinc oxide. Normally the color of zinc oxide is not absolutely white and is due to minute traces of other metals, such as copper, iron and cadmium. By digesting a roasted zinc ore with ammonium sulphate a precipitate of basic zinc sulphate is obtained, which is then washed and dried to decompose the ammonium salt. It is then digested further with soluble alkali, which converts the zinc into a mixture of zinc hydroxide and zinc carbonate. This mixture is finally dried and calcined at a low heat to produce commercial zinc oxide, which, however, has an extremely high purity due to the preliminary treatment. (1,445,366. Feb. 13, 1923.)

Agitator—The object of this invention is the construction of an agitator which automatically produces an influx of air into the agitated mass during operation. In order to accomplish this the rotating stirring device is provided with an air passage having an outlet so placed that it discharges the air directly into the agitated mass. The inlet of this air passage connects with a scoop for the entrance of air, which is drawn in by compression within the scoop and by the displacement of liquid produced during the rotary movement of the agitator. In operation air is forcibly ejected through the arms of the stirring device into the agitated material in such a way that a complete mixture of air and material is obtained. While this apparatus is particularly designed for the process of concentration by flotation in handling ores, it will have numerous other applications where agitation and separation or concentration are to be effected at the same time. (1.445,935. Arthur C. Daman and Thomas J. Pennington. Feb. 20, 1923.)

Selenium Oxychloride as a Solvent—Victor Lenher, of Madison, Wis., has suggested the use of selenium oxychloride for dissolving unsaturated hydrocarbon compounds of various kinds. This includes rubber, both pure and vulcanized, Redmanol, Bakelite and Condensite, resins, glues, gelatin, celluloid, varnish, lacquer and paints. The solvent action may be increased by adding 20 per cent sulphur trioxide and diminished by diluting with carbon tetrachloride, 2.75 per cent by weight. (1,445,329. Feb. 13, 1923.)

Process for Making Plastic Compositions—A. A. Backhaus, of Baltimore, Md., has assigned to the U. S. Industrial Alcohol Co. a mixture from which a plastic composition may be made. The patent covers the use of ethyl aceto acetate as a camphor substitute in such compositions—for example, 10 oz. by weight of cellulose nitrate, together with a gallon of suitable solvent, such as acetone, amyl acetate, etc., and anywhere from 1 to 4 oz. of ethyl aceto acetate. After this material is hardened it behaves very similarly to the camphor-made product and it is claimed that ethyl aceto acetate provides flexibility and pliability, which obviates brittleness, opacity and blushing. (1,437,952. Dec. 5, 1922.)

Recovery of Waste Potash Liquor—C. T. Whittier has assigned to the Royal Baking Powder Co. of New Jersey a patent whereby the waste potash containing liquor from a tartaric acid manufacture may be recovered. Always in the past this material has been thrown to waste because, in evaporating, calcium sulphate separates out and the organic matter coagulates. This leaves a viscous mass very difficult to handle. By utilizing a spray drier it is possible to obtain this material in an available form. (1,442,317. Jan. 16, 1923.)

Production of Soluble Resins From Furfural—G. H. Mains and Max Phillips of the Department of Agriculture have developed nine soluble resins by heating furfural with the following substances: Meta-nitraniline, alpha-naphthylamine, para-toluidine, beta-naphthylamine, meta-toluylenediamine, methyl ethyl ketone ortho-toluidine, cymidine and xylidine. The process in general is to heat furfural with two parts of the other material (in some cases this is varied) for several hours under a temperature which varies from 150 to 200 deg. The various conditions are for the purposes of abstracts unimportant. (1,441,598. Jan. 9, 1923.)

Manufacture of Orthosulphonic Acids of Aromatic Amines—J. Baddiley, Joseph B. Payman and Harry Wignall, of Blackley, Manchester, England, have assigned to the British Dyestuffs Corporation, Ltd., the following process for the preparation of orthosulphonic acids of aromatic amines. The chlorsulphonic acid of the amines is dissolved in a suitable solvent which will be unattacked by chlorsulphonic acid (tetrachlorethane is used frequently in this work). This process gives often a chlorsulphate addition product which sometimes separates out as a precipitate and may be filtered from the solvent. The material is then transformed into the sulpho acid with the elimination of hydrochloric acid. (1,441,655. Jan. 9, 1923.)

Two-Stage Process for Coke Manufacture—The method for coking proposed by James G. West is a two-stage process intended to produce high-grade metallurgical coke from high-volatile coal which is claimed to be otherwise not suitable for this purpose. In the first stage some coal is carbonized for reduction of the percentage of volatile matter, preferably to about 17 to 20 per cent, but in no event less than 6 to 10 per cent volatile. This semi-coke is ground and mixed with more of the original coal and the mixture carbonized as usual. (1,445,735. Feb. 20, 1923.)

Use of Lepidolite in Vitreous Enamels—Alexander L. Duval d'Adrian, of Washington, Pa., has assigned to B. F. Drakenfeld & Co., of New York, a patent covering the use of lepidolite in vitreous enamels. Used either in the frit or in the ground mass, or in both, it is claimed that a higher grade stronger enamel is produced which is more serviceable and which does not crack or craze. Where tin oxide is used, it is claimed that this may be replaced in part by lepidolite, producing a higher grade product at lower cost. (1,443,813. Jan. 30, 1923.)

British Patents

For complete specifications of any British patent apply to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Explosives—Salts of azidothiocarbonic acid, which may be obtained from sodium azide and carbon bisulphide, are used in priming compositions — for example, with phlegmatizing agents such as resin or paraffine solution. The lead salt is of special importance and can be obtained from the sodium salt by treatment with lead nitrate. (Br. Pat. 188,302; not yet accepted. H. Rathsburg, Fürth, Germany. Dec. 29, 1922.)

Absolute Alcohol—A continuous process for the production of absolute alcohol consists in mixing alcohol of 95 to 96 deg. Gay-Lussac with powdered quicklime or other suitable dehydrating agent and distilling the greater part in a continuous still, collecting the alcohol, and continuously withdrawing the remaining liquid mixture, diluting it with water and delivering it to a rectifier, where it is exhausted of its alcohol which is concentrated to 96 deg. and again subjected to dehydration. In the apparatus shown in Fig. 1 lime and alcohol are mixed in a large stirrer *A* and delivered by a valve *B* and pump *C* to a heater worm *D* and thence to a continuous still *E* with steam jacket *F* and stirrers. The alcohol is condensed in the heater *D* and cooler *G* and flows out through a testing device *H*. Only about three-quarters of the alcohol is thus distilled, the remaining liquor being continuously tapped off by a pipe *e*, diluted with water by a cock *S* and funnel *T* and delivered to a continuous exhauster *KL*, the lower part of which is provided with bubbling plates constructed so as to prevent incrustation with lime. The base *M* is heated by a steam bubbler which drives the alcohol into the upper part *L* of the column, where by means of a reflux *N* it is rectified to 96 deg. and may be withdrawn through a testing-device N^1, and returned to the apparatus for further dehydration. The calcic mud collecting at the base *M* is passed into an extractor *Q* with float *q* operating an exit valve *R*, whereby a constant level is maintained in *M*. In the simpler form of the apparatus shown in Fig. 2 the preliminary reaction between the alcohol and quicklime is dispensed with, the crude alcohol being delivered direct to the upper plate of the column *K* through a heater *X* heated by waste steam from the exhauster *K*. Pasteurized alcohol is drawn off from the column *L* by the pipe *u* to a measuring device *U* and thence to the still *E*, E^2 which carries a partition E^1 dividing the unheated port on *E* from the portion E^2 which is heated by the steam-jacket *F*. Quicklime is dropped into *E* in measured quantities by a rotating recessed plug tap *P*. It is stated that the testing device *W* also serves to separate any aldehyde products. If incomplete dehydration is required the pasteurized alcohol may be drawn off at *U*. Instead of quicklime, fused calcium chloride, anhydrous potassium carbonate, anhydrous sodium or copper sulphate or anhydrous sodium acetate may be employed. (Br. Pat. 189,136; not yet accepted. Barbet et Fils et Cie., Paris. Jan. 17, 1923.)

FIG. 1.

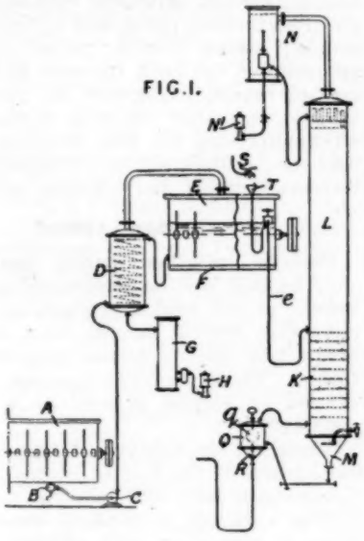
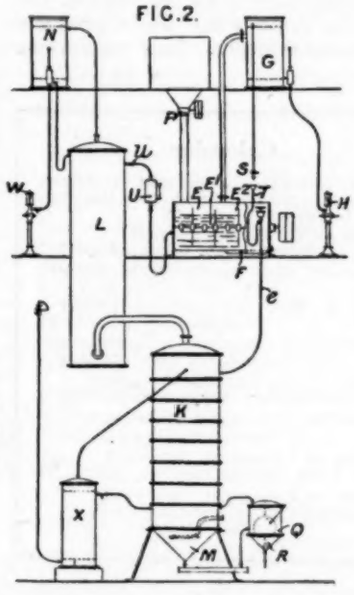


FIG. 2.



Dyeing Cellulose Acetate—In the production of azo dyes on the fiber or material of cellulose acetate silk, films, etc., soluble salts are added to the baths containing the parent amines or the developers or to both; suitable salts are the chlorides of ammonium, sodium, potassium, barium, calcium, magnesium, zinc or tin, or sulphates of sodium, potassium or magnesium. Protective colloids, such as gelatine, boiled-off liquor, soaps, turkey red oils, etc., may also be added when the bases or developers are used in neutral or alkaline baths. In an example, acetate silk is first treated in a bath containing dianisidine hydrochloride, magnesium chloride and sodium bicarbonate, then passed to a diazotizing bath, followed by a developing bath containing alpha-naphthylamine hydrochloride and sodium bicarbonate, after which it passes to a second diazotizing bath and a second developing bath containing alpha-aminonaphthol, boiled-off liquor, and magnesium chloride; a black shade is obtained. Specification 176,535 is referred to. (Br. Pat. 187,964; not yet accepted. R. Clavel, Basel, Switzerland. Dec. 20, 1922.)

Dyeing—The waste liquor from aniline black dyeing in which ferrocyanide is used is treated with ferrous sulphate so that the liquor is acid or neutral, and the precipitated blue is separated. The precipitate, which is of no value as a pigment, is dissolved by treatment with an alkali, alkaline earth or ammonia, a hydrate of iron being also produced. To the liquor is then added an excess of an organic or inorganic acid, or first a ferrous or ferric salt and then excess of the acid, when a blue precipitate is obtained which is a good pigment. (Br. Pat. 188,208. Bleaching and Dyeing Co., Ltd., and A. J. Hall, Congleton, Cheshire. Dec. 29, 1922.)

Carbon and Briquet Fuels—Peat, lignite, sawdust, or other carbonaceous material is preliminarily treated with a potassium or sodium salt such as carbonate, chloride, sulphate, acetate or phosphate, either by wetting the material with a solution of the salt or, if already wet, by intimately mixing with the salt dissolved in the least possible amount of water, and is then carbonized by roasting the mass on a hot plate while freely exposed to the air. According to an example, sodium carbonate or soda crystals are employed. To obtain a pure carbon the product is boiled with dilute hydrochloric acid and dried. The carbon produced may be worked up into briquets for fuel by use of a binder such as gluten, molasses or casein treated with formaldehyde. (Br. Pat. 188,807. A. M. Hart, London. Jan. 10, 1923.)

Extracting Copper, Lead and Silver Ores—Ores are treated with nitric acid of at least 40 per cent in the presence of iron or acid-soluble iron compounds equivalent to the metals other than iron in the ore, the iron nitrate produced being the effective attacking agent. After the separation of the iron hydrate, the nitrate solution may be treated with sulphuric acid to precipitate the lead and then by cementation to obtain first the silver and then the copper; or the solution after the removal of the lead and silver may be treated with sulphuric acid to obtain crystallizable sulphates which owing to their water of crystallization leave the liberated nitric acid in a concentrated state. Alternatively instead of cementation as above described the metals may be obtained by fractional electrolysis. (Br. Pat. 188,865. J. S. Wetzlar, London. Jan. 10, 1923.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

Industrial Alcohol Interests Get Into Action on Drastic Restrictions

Sugar Men Turning Blackstrap Into Methanol—Senator Broussard Urges Utilization of All Available Waste

EVIDENCE is plentiful that the industrial alcohol situation rapidly is reaching a climactic stage. Prohibition enforcement officials propose more drastic regulations than those now in force. On the other hand, the chemical interests, including the sugar producers and those concerned with the expanded use of alcohol as a stove fuel and for internal combustion engine fuel, are ready to combat any more stringent regulations which tend to discourage the manufacture of industrial alcohol. More and more these interests are insisting on being relieved of the provisions of existing regulations which are throttling an industry of increasing importance.

Senator Broussard's Speech

It is understood that wide distribution is to be made of a recent speech made on the floor of the Senate by E. S. Broussard of Louisiana. Senator Broussard's principal interest in industrial alcohol springs from the sugar industry, with which he has been intimately associated all of his life. In the course of that speech, he said:

"While Australia recommends a bonus and many nations are appointing commissions to encourage the manufacture of industrial alcohol, we persist in this foolish course of prohibiting the manufacture of a commodity on the assumption that the manufacturer is a criminal and a crook and may interfere with some sumptuary measure. If we persist, we will find, within 20 years, when gasoline will be scarce, that the advances made in the internal combustion alcohol engines will have been made by foreigners, thoroughly safeguarded by patent rights."

A Crime to Discard Waste

In his address Senator Broussard contended that farm wastes should be made into alcohol. Such use should be made of surplus crops. He cited years in which farmers burned their corn as fuel because it was cheaper than coal and when millions of bushels of potatoes were allowed to rot in the field for lack of market. He pointed out a statement from the Bureau of Chemistry showing that alcohol could be made in 1922 at a cost of 6 cents a gallon from blackstrap molasses, and 7 cents a gallon from corn. "However," he said, "the hand of death was effectively laid upon such use of surplus materials by regulation No. 30, issued on Sept. 29, 1916, by the Commissioner of Internal Revenue. Although the statutes in the original form gave the right to the farmer to convert his waste products into industrial alcohol, these regulations absolutely defeat the law and make it impossible for him to do so."

In Hawaii the sugar producers long have made their own alcohol for use as motor fuel and for stove fuel. Just at this time the domestic sugar producers are taking up actively the use of their low-grade molasses in the manufacture of alcohol, due to the recent rise in the price of gasoline.

Calendar

The following important technical meetings are scheduled for the immediate future:

AMERICAN CHEMICAL SOCIETY
New Haven, Conn., April 3-7

AMERICAN ELECTROCHEMICAL SOCIETY
New York City, May 3-5

AMER. SOCIETY MECHANICAL ENGRS.
Montreal, May 28-31

AMERICAN FOUNDRYMEN'S ASSOCIATION
Cleveland, O., April 28-May 4

AMERICAN OIL CHEMISTS' SOCIETY
Hot Springs, Ark., April 30-May 1

SOCIETY OF INDUSTRIAL ENGINEERS
Cincinnati, O, April 18-20

SOCIETY OF CHEMICAL INDUSTRY
New York, regular meeting, March 23

SOCIETY OF CHEMICAL INDUSTRY
New York, joint meeting with other societies, April 20

Botanist Finds New Use for Aluminum Sulphate

Experiments conducted by Dr. Frederick C. Coville, a botanist of the Department of Agriculture, have developed the fact that aluminum sulphate when applied to ordinary soil is an effective and inexpensive method of changing the soil reaction from neutral or alkaline to acid. Where soils have been treated with crude aluminum sulphate marked stimulation of growth of certain plants has been noted.

To Study Chemical Tariff

Several Chemicals on List to Be Investigated in This Country and Abroad by Experts

The Tariff Commission, after reference to the President regarding its authority to proceed, has announced field investigations into seventeen commodities regarding which applications for changes in duties under the flexible tariff section of the new act have been received. Included are seven items in the chemical schedule: oxalic acid, paragraph 1, in which an increase is sought; diethyl barbituric acid and derivatives thereof, paragraph 5, increases sought; barium dioxide, paragraph 12, applications for both increase and decrease; casein, paragraph 19, increase sought; potassium chlorate, paragraph 80, applications for both increase and decrease; sodium nitrite, paragraph 83, increase sought; and logwood extract.

Investigations Abroad

Decision whether public hearings shall be held will be determined by the results of the field investigations. In any event several months must elapse before any definite results may be obtained. These investigations are to be carried on abroad as well as in this country.

Three representatives of the chemical section of the United States Tariff Commission will embark for Europe within a month to conduct investigations in connection with relative costs of production here and abroad of these chemicals. Germany, France, Switzerland and England will be visited in carrying out the study.

Personnel of Investigators

Dexter North and M. G. Donk will leave first and will remain as long as is required to complete the investigations. They will be followed by C. R. DeLong, chief of the section, who probably will remain abroad 2 months to supervise the work in Europe. On his return he will present a report to the commission regarding the changes that will be necessary. Much interest is aroused as to the outcome of the application of this flexible provision of the tariff.

Some difficulty is expected by the commission in obtaining foreign production costs in certain instances, but it has been suggested that the price level at which an imported article sold in this country over a given period could be used as a basis for comparison.

Comment on the Chemical Equipment Association

Notable Scientific, Commercial and Government Representatives See Benefit to Business

Many notable figures in chemical industry and the general world of chemical activity have recently commented approvingly on the activities of the Chemical Equipment Association. The association was formed a few months ago by leaders in equipment manufacture and now embraces a national membership of companies manufacturing essential equipment for the chemical, metallurgical and technical process industries.

Brigadier-General Amos A. Fries, chief of the Chemical Warfare Service, recently wrote to the association: "The activities of your organization, I believe, will be of great benefit to the general field of chemical industry." Charles L. Reese, chemical director of E. I. du Pont de Nemours & Co., expressed himself to the association recently as follows:

"I have no doubt that the Chemical Equipment Association can be of great value not only to the chemical equipment manufacturers but also to the chemical manufacturers. As an illustration of the co-operation between chemical manufacturers and the Chemical Equipment Association I might mention a recently appointed committee of the Manufacturing Chemists' Association for the standardization of the chemical ware forms which is to co-operate with a similar committee of the Chemical Equipment Association to bring about these standards, which will make it unnecessary for chemical manufacturers to maintain such large stocks of earthenware, glass, etc., for repairs when a great number of the equipment manufacturers hold in stock standard equipment."

A.C.S. Approves

"One of the most striking letters we have had," according to Pierce D. Schenck, president of the association, "is from the secretary of the American Chemical Society, Charles L. Parsons. Mr. Parsons has written us: 'I have watched with real interest the foundation of the Chemical Equipment Association. I believe it has a decided field for usefulness, and I am confident from the strong names that appear on your letterhead and from others whom I know to be members of your association, that it will do great good toward increasing the quantity and standardizing the design and use of chemical equipment and will be very helpful in the development of American chemical industry.'"

E. W. Washburn, chairman of the division of chemistry and chemical technology of the National Research Council, has also expressed his belief in the advantages to the chemical field as a whole that will accrue from the association, in a letter saying:

"In my opinion trade associations which cover both the producers and the consumers are in the long run likely to prove of the greatest advantage to both parties concerned. . . . The formation of these associations is an indication of great advances which the future will bring forth in the direction of co-operation between manufacturers and users and the increase of scientific knowledge which will result from the research work initiated and supported by such associations."

Malay Rubber Exports Grow Despite Drawbacks

Despite the restricting legislation of the British, rubber exports from Malay continue to grow. During January, 1923, 22,871 long tons of rubber was exported from British Malayan ports, as compared with 18,427 long tons in December, 1922, and 21,642 tons in November, the first month during which the restriction scheme was in effect, according to reports received by the Department of Commerce. The total of 62,940 tons during the 3 months may be compared with 55,257 tons during the corresponding period of 1921-1922.

Texas Engineers Stage Trip

Thirty-five junior and senior chemical engineering students of the Texas Agricultural and Mechanical College, accompanied by the head of the department, Dr. C. C. Hedges, made an interesting field trip on March 7 and 8 through Dallas plants. They inspected the Oak Cliff paper mill, the works of the East Texas Chemical Co., the Dallas sewerage disposal plant and the White Rock filtration plant. While in Dallas, the delegation attended a session of the local branch of the American Chemical Society, and later was present at a barbecue given by the Texas Portland Cement Co.

Yale to Do Silk Research

A fellowship has been established at Yale in silk research by Cheney Bros., silk manufacturers of South Manchester, Conn. This will be awarded to a graduate student who has shown special proficiency in chemistry and biochemistry, and demonstrated his ability to pursue research work leading to the degree of Doctor of Philosophy. The recipient of this fellowship is to conduct research on some fundamental problem the solution of which will advance the knowledge of the chemistry of silk and substances and processes used in the silk industry.

Bauxite Again Mined in British Guiana

A considerable force of laborers has been placed at work at the mines and plant of the Demerara Bauxite Co., and it seems probable that a resumption of shipping of this material will begin shortly, according to a report to the Department of Commerce from Consul Chester W. Davis, Georgetown, British Guiana.

Olive Oil Foots Ruling Is Made Public by Treasury

Decision Makes Sulphur Olive Oil, Sulphured Olive Oil and Olive Oil Foots Duty Free

The contention between soap and oil importing interests is settled. No duty is to be levied on olive oil foots, according to the official ruling recently made public by the Treasury Department. The text of the ruling as made in the form of a letter from Assistant Secretary Moss to the Collector of the Port of New York is as follows:

The department refers to your communication of the 3d ultimo, in which you state that it is the practice at your port to pass olive oil foots free of duty under paragraph 1632 of the tariff act as unfit for use as food or for any but mechanical or manufacturing purposes.

In view of the information supplied relating to sulphur olive oil, sulphured olive oil and olive oil foots, the department is of the opinion that the three names as used in the United States relate to one and the same article, it being an olive oil obtained by the use of a solvent known as carbon bisulphide or carbon disulphide.

Provision for Free Entry

The provision in paragraph 1632 for the free entry of olive oil rendered unfit for use as food or for any but mechanical or manufacturing purposes by such means as shall be satisfactory to the Secretary of the Treasury and under regulations to be prescribed by him, is a re-enactment of a previous provision which appeared in paragraph 639 of the tariff act of Aug. 5, 1909, and paragraph 561 of the tariff act of Oct. 3, 1913.

The department in T.D. 29957 promulgated regulations in regard to the denaturing of olive oil under paragraph 639 of the tariff act of 1909, and in these regulations provided that "sulphured olive oil obtained by the extraction of olive oil from press cake by means of carbon bisulphide need not be further denatured."

In a later decision, T.D. 34215, collectors were authorized to sample only 10 per cent of importations of oil invoiced as sulphured olive oil or olive oil foots or olive oil which had been rendered inedible abroad.

Provisions of Tariff

Under the provisions of the tariff acts of 1909 and 1913, above cited, merchandise known as sulphured olive oil or sulphur olive oil and olive oil foots was admitted free of duty and it must be presumed that the Congress had knowledge of the department's regulations authorizing the free entry of the merchandise under consideration, and the department is of the opinion, therefore, that its re-enactment of the provision in paragraph 1632 must be regarded as legislative sanction of the department's regulations and the practice of admitting this merchandise free of duty.

In view of the foregoing, the department approves your practice of admitting free of duty sulphured or sulphur olive oil or olive oil foots under paragraph 1632 of the tariff act.

U. S. Wants Dust Engineers

Competitive civil service examinations are to be held on April 24 for assistant and associate dust explosion engineers, and on April 25 for junior dust explosion engineer. Entrance salaries will range from a minimum of $1,440 for junior engineer to a maximum of $3,000 for associate engineer. The duties of these engineers are to be in connection with investigations relative to the cause and prevention of dust explosions and resulting fires.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or secretary of the board of U. S. civil service examiners at the post office or custom house in any city.

Government Standardizes Metal Specifications

Organized Committee Now at Work Methods Being Employed Recognize Interests of Government and Industry

The Federal Specifications Board has appointed a technical sub-committee to which is assigned the task of coordinating all existing metal specifications of the several government departments and recommending such new specifications for metals as may be required. The personnel of the committee includes representatives of various technical and supply bureaus of the Navy, War, Commerce and Interior Departments.

Existing navy, army or other government specifications when available are used as a basis for the writing of all specifications. If no existing government specifications are available, commercial specifications such as those of the American Society for Testing Materials or Society of Automotive Engineers are made use of. When possible specifications from several sources are utilized.

How Specifications Are Drawn

Umpire methods of chemical analysis are being incorporated as a part of all specifications. The standard methods of chemical analysis adopted by the American Society for Testing Materials are being used where they apply. When the latter are not available, methods are being developed by the Chemistry Division of the Bureau of Standards. Preliminary specifications are submitted to authorities in the metal industries before adoption. The interests of both the industry and the government are considered in arriving at a satisfactory specification.

Work So Far Accomplished

The specifications before the federal board at present are: Pig lead; phosphor tin; silicon copper; ingot copper; ingot tin; slab zinc; phosphor copper; steel castings; foundry pig iron; high-test gray iron castings; gray iron castings; malleable iron castings; washed metal; silver solder; spelter solder; tin lead solder; manganese bronze castings; aluminum bronze castings; welding wire, iron and steel; copper-nickel alloy castings (Monel metal).

Huston Resigns to Head Huge Oil Corporation

Assistant Secretary of Commerce C. H. Huston has resigned to accept the presidency of the World Commerce Corporation, which has applied for a federal charter.

According to Mr. Huston, the World Commerce Corporation has been organized by substantial New York and Pittsburgh business men for the purpose of exploiting both foreign and domestic oil properties. The claim is made that "half of the oil-producing lands in the world" are controlled by this corporation.

Wainwright Urges Readiness

"Organization for rapid industrial mobilization is necessary," declared retiring Assistant Secretary of War Wainwright, "if we are to be prepared for another war." He also pointed out our specific deficiencies at the present time. His idea of the problem is that of insuring, "so far as foresight may provide, that our industrial establishment and factories be prepared upon outbreak of war to turn rapidly from their peace-time tasks to the production and creation of those things that shall have the primary preference."

The Three Essentials

Roughly, there are three great elements of supply to be provided:

"1. Those things which the ordinary or current productive capacity of the country can be relied upon to furnish.

"2. Technical supplies, such as munitions and aircraft.

"3. The strategic materials—namely, those not produced in sufficient quantity within the continental limits of the United States, such as nitrate, metal alloy, tin, rubber, platinum, tungsten and the like.

"This will show that unless we actually construct in time of peace sufficient reserves of certain vital equipment and accumulate working reserves of strategic raw materials we cannot produce within the continental United States we would not be able to hold our lines during the early period of the war."

Pulped Currency Used for Paper Making

The Forest Products Laboratory at Madison, Wis., has received from the Treasury Department 150 lb. of currency cut up and pulped to be deinked and made into paper. It is estimated that the sheets of pulp represented approximately $2,500,000. The first run of paper made in the laboratory resulted in a poor quality because of a high percentage of foreign particles in the bills. Later runs indicate better success in making a clean product. As 2 to 3 tons of bills per day is macerated at the Treasury Department at Washington, the reclamation of the pulp is of importance even if the product can be used only for wrapping paper.

To Take German Nitrates on Reparation Account

Official announcement has been made that Germany has begun direct negotiations with Italy regarding deliveries of nitrates on the reparation account. A statement to this effect has been sent to the Reparations Commission in reply to an invitation that Germany enter into conference relative to such deliveries to France, Belgium and Italy. Owing to the Ruhr occupation, the German Government is not in a position to make deliveries to France and Belgium, and therefore has announced that it will not send representatives to the contemplated conference.

Founders Program Announced

Aluminum Alloys, Sand Investigations and Modern Developments in Foundry Practice to Be Discussed

Arrangements for the Cleveland meeting of the American Founders Association, April 28 to May 3, are nearly complete. The sessions and talks as planned cover a wide range of subjects. Probably of most general interest to all foundrymen will be the two sessions on foundry sand investigations. The joint sand investigation committee of the A.F.A. and the National Research Council will present progress reports of investigations of methods of testing sand, reclamation investigations and of progress in securing geological surveys of the foundry sand resources of the country. A great amount of work has been done by this committee since the Rochester meeting and much information of value to the foundrymen will be presented at these sessions.

Aluminum Alloy Session a Feature

The subject of aluminum and aluminum alloys will be considered at a joint session of the A.F.A. and the A.I.M.E. The developments in this branch of the industry have been so great that the papers committee decided to continue the practice inaugurated at Rochester of devoting at least one session to papers and discussion on this subject. In addition to the usual sessions on steel and cast iron there will be a session for the discussion of the new developments in the foundry world. The electric furnace and centrifugal casting will feature in this session.

The Institution of British Foundrymen will be represented on the program by an address by Dr. Percy Longmuir, one of the world's most foremost metallurgists, who has devoted his life to improving foundry practice.

National Safety Council To Hold Winter Meeting

Handling material, dust and fume hazards and traffic safety are the three main topics on the program of the meeting of the midyear conference of the National Safety Council to be held April 17 at Chicago, Ill.

The morning session will deal with causes of accidents in handling materials, and use of conveyors and trucks in eliminating material handling accidents, followed by a general discussion of specific safety problems in material handling. George T. Fonda, chairman of the Engineering Section of the Council, will preside at the morning meeting.

Preventing dust fires and explosions, health protection against dust, and a discussion of practical methods of dust and fume removal will follow in the afternoon. Homer E. Niesz, treasurer of the National Safety Council, will preside at the banquet in the evening, at which traffic problems will be discussed.

Eyesight Council Elects Officers for Coming Year

Important Work of Conservation Being Carried On in Schools and Factories —Officers Are Announced

A campaign to eliminate economic and physical losses due to poor eyesight in schools and factories is being carried on by the Eyesight Conservation Council of America. L. W. Wallace, executive secretary of the Federated American Engineering Societies, has been re-elected president of this association. Defective vision as a source of industrial waste was revealed by the Hoover Committee on Elimination of Waste in Industry, of which Mr. Wallace was vice-chairman.

Prominent Men Directing

Associated with Mr. Wallace as members of the board of directors and of the board of councilors of the Eyesight Conservation Council, according to the announcement of the election of officers for the coming year, are several prominent engineers, including Prof. Joseph W. Roe of New York University, president of the Society of Industrial Engineers; Dr. Morton G. Lloyd, chief of the Safety Section of the U. S. Bureau of Standards and vice-president of the American Society of Safety Engineers; G. E. Sanford of West Lynn, Mass., past-president of the American Society of Safety Engineers.

Recently Elected Members

Prof. F. C. Caldwell, of the department of electrical engineering, Ohio State University, and Secretary of Labor James J. Davis are recent additions to the governing bodies of the Eyesight Conservation Council. Engineering methods will be employed by the Council in surveys which are to be conducted in schools and workshops. Guy A. Henry of New York has been re-elected general director of the Council and will actively direct the eye campaign from the Council's national headquarters in New York City.

Wisconsin Metal Men Convene

At the request of the Wisconsin Foundrymen's Association, a statewide "Metals Convention" will be held at the University of Wisconsin under the auspices of the department of mining and metallurgy of the College of Engineering. There are 320 foundry groups with 700 different foundries in the state. During the convention a large exhibit of foundry machinery and equipment will be held in the University Stock Pavilion. The Society for Steel Treating will hold a meeting at the university at the same time and will have a separate exhibit of steel-treating methods, appliances and results.

The foundrymen are planning to organize at the convention a statewide association to further co-operation among themselves and with the university for the study of their technical problems.

Boll Weevil Fight Is On

Disagreement Between Active Agencies Does Not Interfere With Progress —Purchasing Bureau Projected

Although there is continued disagreement between the two great agencies aiming at extermination of the boll weevil—namely, the American Cotton Association and the National Campaign for Boll Weevil Control—still it appears that progress is being made.

Dr. Miller Reese Hutchinson has announced the co-operation of Luther Burbank in the N.C.B.W.C. From several statements made during the past week, it appears that Dr. Hutchison is to obtain much support in his campaign. The U. S. Department of Agriculture has signified its willingness to co-operate in every possible way.

Arsenate Agency to Be Formed

M. L. Tilton is in charge of an agency designed to stabilize the market for calcium arsenate. According to the plan a central purchasing bureau is to be established in New York which will contract with various manufacturers over varying periods. This agency will in turn distribute the material so purchased to state agencies, which will be placed in operation in each of the cotton states. The central agency will be placed upon a business basis and do business at sufficient profit to cover the expense of handling the work. Any surplus remaining after the expenses have been paid will revert to the National Campaign, to be used in still further pushing the work of eradicating the boll weevil.

Estimate of Available Arsenate

The amount of arsenate available for combating the weevil this year is far in excess of last fall's estimates. It is stated by R. N. Chipman, insecticide manufacturer, that 22,500,000 lb. of calcium arsenate is in sight. He adds, however, that because of an inactive market, exhaustion of this supply is not unlikely, because manufacturers are unwilling to put difficultly available white arsenic into a form which may not sell.

Government to Use Airplanes

Besides the use of arsenic in the usual manner several other ideas have recently been advanced. One of the most interesting is that of using army planes in spraying, an idea which has met with the approval of the Secretary of Agriculture, who has stated that planes will be used in Louisiana to spray calcium arsenate over experimental fields to determine just how efficacious the treatment from the air will be.

The Department of Agriculture believes that spraying the cotton plants twice daily with calcium arsenate broken into fine particles by the force of the propellers may control the activities of the boll weevil in such a way as to make cotton raising profitable, even in infested areas.

Makes Survey of Scientific Activities in United States

National Research Council Receives Report Concerning Details of Investigations

The co-operative scientific work carried on by the Federal Government and outside agencies is the subject of a report recently submitted to the National Research Council. According to this, there are 553 agencies engaged in research work in the United States, under which more than 1,100 co-operative undertakings are involved. Of these projects approximately 66 per cent can be described as engaged in the acquisition of new knowledge through scientific investigation. The remaining projects have directed their attention to technical service, the gathering of statistics and the enforcement of regulatory measures.

Agencies at Work

In the federal agencies engaged in co-operative work are included twenty-three bureaus and independent establishments maintained by the government. The outside co-operating agencies include various branches of the state governments, municipalities and Chambers of Commerce, endowed universities, etc.

According to the available data, more than $41,000,000 has been expended during the past year in the interests of federal and outside co-operators in definitely organized scientific work for the government. Of this amount, over $14,000,000 was supplied by the federal government, the balance being given by outside agencies.

In making this investigation, the central government had as its object the provision for more adequate scientific investigation of matters of general interest from a national or a regional viewpoint, and the promotion of nation-wide movements of various kinds. In general the forms of agreement or understanding entered into among these co-operating parties are for the purpose of avoiding misunderstanding and of fostering the spirit of co-operation.

Cleveland A.C.S. Hears Slosson

The March meeting of the Cleveland Section of the American Chemical Society was held in co-operation with the Cleveland Engineering Society, Tuesday, March 20, 1923. Dr. Edwin E. Slosson addressed the meeting, to which the Cleveland Chamber of Commerce was invited, on "Chemistry Applied to Industry."

Molybdenum Source Found

A deposit of blue molybdenum ore, rare in the United States, has been discovered near Ouray, Utah. This is the largest known source in the country. A report on this ore is to be issued in the near future by Dr. F. G. Hess of the Geological Survey.

A.C.S. Spring Meeting Plans Near Completion

New Haven Accommodation Problem Being Worked Out—Details of Social Affairs Arranged

In spite of the fact that practically all available hotel rooms in New Haven have been already reserved for the week of April 2 to 7, the executive committee of the American Chemical Society has arranged through the kindness of the people of New Haven to take care of everybody who comes. The Y.M.C.A., Y.W.C.A. and Chamber of Commerce of New Haven have furnished the hotels committee a large list of private homes where rooms may be obtained for the week. To give the local committee ample time, everyone who plans to attend is requested to write as soon as possible to Dr. Ralph Langley, 84 McKinley Ave., New Haven, regarding room reservations. The committee gives assurance, however, that last-minute reservations will be provided.

Council and Reunion Dinners

The councilors' dinner on Monday night is also open to all members of the A.C.S. who purchase tickets obtainable at Byers Hall. An attractive program has been arranged including brief addresses by noted and able speakers.

The time between the close of the section meetings and the polo game on Thursday will be devoted to fraternity and alumni dinners. These "reunion" dinners should prove a very attractive feature of the meeting. All organizations or groups wishing to get together for a dinner should communicate at once with Dr. Arthur H. Smith, 84 Woodlawn St., Hamden, Conn.

As a matter of convenience it will not be necessary to arrange Pullman reservations for the return trip at the railroad station, facilities for this being provided at headquarters at Byers Hall. This service will be in charge of N. C. Magnus, whose office is located at 219 Elm St.

Metal Inquiry Proceeds

Delayed organization of the commission to investigate the gold and silver situation has resulted from the absence and illness of several of its members, including that of the proposed chairman, Senator Nicholson of Colorado.

This time will not be lost, however, as literature on the subject is being assembled and abstracted. Abstracts also are being made of the experiences of commissions and committees which have investigated monetary or precious metal questions in the past. An analysis is being made of freight rates on gold and silver ore as compared with the rates on other commodities. Other basic information is being gathered so that the commission when it meets in April will have before it in concise form the results of similar inquiries in the past and certain other data which will make possible a more intelligent determination of the scope of this investigation.

Paper Exhibition Progress Indicates Success

The list of exhibitors at the Paper Industries Exposition, which is to open at Grand Central Palace, New York, on April 9, indicates that the story of paper is to be well told. Final plans are being formed for the conventions of the T.A.P.P.I. of the A.P.P.A. and of the National Paper Trade Association, all of which fall during the week of the exposition. Government films dealing with the forestry end of pulp are to be shown, and special programs have been arranged on different days. The exhibits are to cover practically every phase of paper making from preparation of raw material to the testing of the finished products. At present the number of exhibits arranged for is approximately sixty. Of especial interest to students of the industry will be the government and Forest Products Laboratory booths.

Montana Arsenic Source To Be Developed

A development of interest has recently taken place in the production of arsenic. The district about Jardine, Mont., has long been the scene of gold mining; but the operations there have been greatly hampered by the arsenical character of the pyrites in which most of the gold values are found. It is now proposed to develop the recovery of arsenic to as large an extent as the market will warrant.

The Jardine Mining Co. has erected a reverberatory furnace with arsenic kitchens, for the purpose of roasting its concentrates and extracting arsenic. The production is 100 tons of white arsenic per month on the present scale of operations. The ores appear to be entirely free of antimony, bismuth or any other element which would interfere with the production of high-grade arsenious oxide.

The present production of this new plant will make no increase in the country's supply of arsenic, as the same amount was formerly removed at the A.S.&R. smelter in Tacoma, Wash., where the Jardine concentrates were shipped. The deposits at Jardine, however, cover a large area, most of which is yet undeveloped; and, when the investment is warranted by the demand, it is expected that the output of the Jardine property will be greatly increased.

Seeks Graduate Assistants

Dean Ketchum, of the College of Engineering, University of Illinois, announces that fellowships are available at that institution for work in engineering research. This may be undertaken in architecture, architectural engineering, ceramic engineering, chemistry, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, physics, railway engineering and theoretical and applied mechanics.

New Jersey Chemists Hear Prominent Speakers

Brigadier-General A. A. Fries and Dr. Hugo Schlatter Address March Meeting

Growing enthusiasm was evidenced in the March 12 meeting of the New Jersey Chemical Society by the fact that the largest crowd ever turned out was on hand to hear the two speakers of the evening, Brigadier-General A. A. Fries, chief of the Chemical Warfare Service, and Dr. Hugo Schlatter, of Philadelphia.

The Artificial Silk Industry

Dr. Schlatter in his talk brought out many interesting points in regard to the artificial silk industry. He outlined its development from early days, the mechanics of the four usual methods involved in its fabrication, the chemistry of these methods and the general economics applying. He made the point that cuprammonia silk is most largely manufactured in Germany, where it was discovered; nitrocellulose silk in France, where Count de Chardonnet first made it; while viscose silk, of Anglo-English origin, is the major industry in England and the United States. In 30 years the annual consumption of artificial silk of domestic manufacture has grown to 30,000,000 lb. in the U. S.

General Fries on War Gas

Unusual moving pictures and photographs of maneuvers with gas on land, on sea and in air attended General Fries' talk on "War Gas, Past, Present and Future." The fact that the press has vastly exaggerated the deadliness and misrepresented the effects of war gases was emphasized by General Fries, who also spoke of the research now being carried on at Edgewood, where the toxic effect of various gases is being studied and new methods of manufacture are being evolved.

Demonstrates Improved Naval Stores Production

Practical, profitable methods of producing rosin, turpentine and similar naval stores are to be demonstrated by G. P. Shingler, government expert, to interested parties in the South during the next 6 weeks. Mr. Shingler will confer with individual producers who may need and desire his advice, assistance and suggestions regarding improvements in operation.

Headquarters at Savannah and New Orleans

Mr. Shingler will have his headquarters during the remainder of March in the U. S. Custom House, New Orleans, La., and during the month of April in the U. S. Custom House at Savannah, Ga. It is suggested that producers desiring to confer with Mr. Shingler write to him in order that arrangements can be made for a conference either at his headquarters in one of those cities or at the place of the producer.

Salesmen Hold Alkali Dinner

Caustic Remarks Not in Evidence at Regular Monthly Program—Roth and French Give Talks

The New York Section of the National Association of Chemical Salesmen held a most successful dinner at the Chemists' Club on March 14. There was plenty of enthusiasm and at the same time an increased evidence of seriousness of purpose and constructive thought. On behalf of the members of the association who attended the lectures given by Dr. F. E. Breithut on chemistry, Mr. Ashbridge presented him with $70 in gold. Dr. Breithut replied felicitously and announced that if the members of the association were interested in pursuing the work next year, he would be glad to arrange it.

With Mr. Dorland as master of ceremonies, Mr. Boyer, the national association president, and Edward Signor were introduced. Both of these men discussed the problems that confront the association and offered suggestions as to the necessary work.

Charles Roth, of the International Exposition Co., spoke on the policy of his company with reference to the Chemical Exposition. He earnestly requested the members to make definite criticisms. The exposition could be successful only if it was representative of all phases of chemical industry and supported by everyone.

E. P. Finch, of the Alkali Export Association, reported a very interesting change in the attitude of the South American countries toward American heavy chemicals. From suspicion and even hostility, they have changed to a receptiveness and even an eagerness to deal with us.

France Lifts Double Duty

More than $30,000,000 worth of goods purchased by the Allies in the Ruhr previous to French occupation are released from the additional duty of 10 per cent which has been imposed. Chemicals, textiles, dyestuffs, steel and machinery which have been held because of the exporters' refusal to pay the double duty imposed will begin to move again if the French official action of release takes its expected effect. Traffic conditions in the Ruhr for these goods are reported by the French as being favorable. Contracts involving unfinished goods, however, are not subject to this tax-exempt ruling, it is understood.

Dust Hazards Report Coming

A report covering the work of the dust explosion hazards committee of the National Fire Protection Association is about to be issued. This will cover tentative regulations for the installation and use of grinding and pulverizing systems for sugar; for the installation and use of pulverizing fuel systems, and for the prevention of dust explosions in terminal grain elevators.

Export Association to Handle Rubber Commodities

Papers have been filed with the Federal Trade Commission for the formation of a rubber export association. This organization, which will include the United States Rubber Export Co., the Goodyear Tire & Rubber Export Co., and the Miller Rubber Export Co., will not be incorporated, however, but will operate along mutual lines in exporting manufactures of rubber and commodities of the rubber industry.

The three companies, it was stated, will use their own individuality and trademarks, but will probably maintain joint offices abroad, with a single sales force. J. B. Tower, of New York, has been named secretary.

Rubber Trouble Continues

Varying Viewpoints Advanced by American and British Interests Concerning Solution

The controversy over the rubber situation grows. Despite unofficial American protest, the British viewpoint, as voiced by such men as Winston Churchill, defends the Stevenson plan. This plan, providing for reduced production of raw rubber in Malay, is aimed to bring up the selling price of rubber to cover production costs. Consumers in the United States believe, however, that Britain is taking unnecessary means of bringing about this end.

The directors of the Rubber Association of America have made the following recommendations to the Rubber Growers Association of London:

"1. That the Stevenson plan for the restriction of crude rubber exports from British Dominions be abolished in its entirety, this recommendation being predicated upon the firm belief that the natural conditions of supply and demand now existing will fully protect the plantation industry.

"2. A request for immediate consideration by the Colonial Government's advisory committee, of which Sir J. Stevenson is the head, of the announcement by the British colonial or the local colonial governments that it use its discretionary powers with respect to the application of this scheme and release rubber without regard to quarterly periods or prices if necessary to prevent wild fluctuations as part of a speculative movement."

Government Action Advocated by Firestone

The group of American rubber men led by Harvey Firestone believes that government action in the matter is desirable. It is now certain that a survey of possible new sources of rubber for United States consumption is to be made. Secretary Hoover has invited the various rubber interests to co-operate with the government in organizing this work. The Philippines and Amazon Valley are considered to be the best fields for investigation.

Paint Men Make Known Activities of Association

G. B. Heckel, Secretary, Shows Facts of Case and Claims No Need of Vindication

From a recent statement of G. B. Heckel, secretary, the public obtains a clear-cut outline of the activities of the Paint Manufacturers Association, which for the past 2 years has undergone investigation by the government and against which, as was stated in *Chem. & Met.* last week, no charges have been sustained.

The statement says in part:

The last thing our organization has ever contemplated was control of prices. Our organization devotes itself to the improvement of the paint industry and the correction of evil practices, such as misbranding, mislabeling, unfair competition and bribery. Among our activities we conduct a research laboratory at Washington, at the cost of $50,000 a year; an unfair competition bureau at Washington, at a cost of $15,000 a year, and a "Save the Surface" campaign, with headquarters in Philadelphia, which is for the creation of greater demand for paint and kindred products, and which costs $200,000 annually. All of these agencies for the benefit of the paint business are open to paint manufacturers of the country whether they are members of the association or not.

In view of these activities for the general good of the business it is hard to understand how there can be any machinery for price fixing. The Sherman act is a very ill-defined law which may be unknowingly violated by the most innocent. However, it would not require an indictment to induce an association like that of the paint manufacturers to correct any tendencies which might have existed toward its violation. As a matter of fact, the association has carefully followed the interpretations of the Sherman law with a view to avoiding any possible infraction. It will continue this policy in the future.

Food Standards Discussed

The Joint Committee on Definitions and Standards held its twenty-fourth meeting in the Bureau of Chemistry, March 12 to 16. Consideration was given to definitions and standards for a number of food products. The committee is composed of Dr. W. W. Skinner, chairman; Dr. F. C. Blanck, and R. E. Doolittle, representing the United States Department of Agriculture; Dr. J. Hortvet, of Minnesota, Dr. C. D. Howard, of New Hampshire, and Dr. E. M. Bailey, of Connecticut, representing the Association of Official Agricultural Chemists; Dr. L. E. Sayre, of Kansas, Dr. W. W. Randall, of Maryland, and Dr. R. E. Rose, of Florida, representing the Association of American Dairy, Food and Drug Officials.

Sulphur Agreement Framed

According to dispatches from Rome the Sulphur Export Association has signed an agreement with representatives of the Italian Government, regarding the control of sulphur sales in Europe. Under it the Italian Government will control the output of the Sicilian beds and will co-operate with the three leading American producers, the Union Sulphur Company, the Texas Gulf Sulphur Company and the Freeport Texas Company in meeting European demands.

Personal

H. E. BARNARD, director of the American Institute of Baking, was in New York, March 10 and 11, to attend the formal opening of the laboratory of the Fleischmann Co.

Colonel LEWIS T. BRYANT has been reappointed State Commissioner of Labor, New Jersey, by Governor Silzer, for a new term of 5 years.

E. J. CUTHBERT, formerly vice-president of the Solar Refining Co., Lima, Ohio, manufacturer of refined oils, has been elected president of the company to succeed J. G. NUBAUER, resigned. N. D. KEYS, heretofore general superintendent, has been appointed secretary and treasurer, succeeding F. G. BORGES, who has been elected vice-president.

P. M. DINKINS, formerly of the Dorr Co., has been made sales manager of the division of heavy chemicals with the Kalbfleisch Corporation, New York City.

General AMOS A. FRIES, head of the Chemical Welfare Service, has discussed the work of this bureau in two recent addresses, one before the New Jersey Chemical Society and the other before the Phi Lambda Epsilon fraternity, Columbia University.

W. S. FRISBIE, Office of Co-operation, Bureau of Chemistry, is conferring with the New Jersey and Delaware state and city officials on the co-operative enforcement of state and federal food and drug laws.

HERBERT S. HARNED, assistant professor of physical chemistry, University of Pennsylvania, Philadelphia, spoke before the Franklin Institute, March 15, on "Radiation and Chemical Reaction."

B. OLNEY HOUGH, for many years editor of the *American Exporter*, has resigned that position to establish himself as an expert counselor, consultant and adviser to banks, exporters and manufacturers. His office is at 17 Battery Place, New York City. He will continue his relations with the *American Exporter*, with the title of contributing editor.

Dr. SABASTIAN KARRER, of the Fixed Nitrogen Research Laboratory, addressed the meeting of the American Physical Society recently on subjects of thermal and electrical ionization as related to problems of nitrogen fixation.

WALLACE MONTGOMERY has been made superintendent of the Central Moron of the Eastern Cuba Sugar Corporation. For some time past he has been assistant superintendent.

A. H. NICKERSON, who since 1904 has been with the American Agricultural Chemical Co., has resigned to accept a position with Stone & Webster, Inc., in the mechanical division. Mr. Nickerson started with the former company as chief engineer, holding that position until 1921, when he was made manager of the manufacturing department.

R. B. MOORE, chief chemist of the Bureau of Mines, has accepted an invitation to deliver an address before the New York Section of the Société de Chimie Industrielle of France, on the occasion of the meeting to be held on May 11.

R. J. QUINN has been transferred to New York City as assistant sales manager of the Mathieson Alkali Works, Inc. JOHN W. BOYER, formerly assistant sales manager, becomes sales manager, and J. A. KIENLE, former sales manager, is now vice-president in charge of sales.

PAUL C. SCHRAPS, of the South American Development Co., sailed March 5 from San Francisco for Ecuador, South America.

A. D. SHAMEL, Bureau of Plant Industry, sailed from San Francisco, Feb. 17, for Honolulu, where for several months, while on furlough, he will continue the work begun in 1920 under the auspices of the experiment station of the Hawaiian Sugar Planters' Association in the application of the principles of the improvement of plants through bud selection to the propagation of sugar cane. Mr. Shamel has spent several months each winter since this work was begun in Hawaii developing it. Through the selection of propogating material a large increase in the yield of sugar has been obtained. While absent in Hawaii Mr. Shamel will further develop the selection work with sugar cane and will endeavor to perfect the methods and to extend their application to the entire sugar industry of the islands.

J. THOMPSON SMITH, at the annual meeting of the stockholders of E. I. du Pont de Nemours & Co., was made general manager of the company's explosives department to succeed the late Charles A. Patterson.

Dr. F. P. VEITCH, chemist in charge of the leather and paper laboratory, Bureau of Chemistry, has been appointed a member of the paper specifications committee of the joint committee on printing, which will prepare standard specifications and samples of paper suitable for the government printing and binding.

JAMES A. WATSON, assistant in the experimental work incidental to the introduction of the Allen process at the du Pont Nitrate Co.'s oficina, in Taltal, Chile, in 1920, and since in charge of the plant, has been appointed assistant manager.

Dr. E. R. WEIDLEIN, director of Mellon Institute, Pittsburgh, Pa., spoke before the members of the Hercules Powder Co., Wilmington, Del., March 5, on the subject "Value of Industrial Scientific Research." The meeting was held at the Trinity Parish House and members of the Delaware Section of the American Chemical Society were invited to attend.

Obituary

Prof. EDWARD WILLIAMS MORLEY died at Hartford, Conn., on Feb. 24. He was probably most widely known for his association with Prof. A. A. Michaelson in the far-famed Michaelson-Morley experiment in relation to the velocity of light. For this work he received the Sir Humphry Davy medal in Great Britain in 1907, while Professor Michaelson received the Nobel prize the same year. There are, however, many other records of major research which stand to Professor Morley's credit. His work on the densities of oxygen and hydrogen in the ratio of their atomic weights was a classic contribution to scientific knowledge, and about forty more papers of profound scholarship and of leading importance were published by him. These included repetition of the Michaelson-Morley experiment in view of the Lorentz-Fitzgerald suggestion that the form of bodies may depend on translation through space or through luminiferous ether. Other contributions were on the atomic weight of oxygen, on variations of the amount of oxygen in the air, the vapor density of mercury from 0 to 100 deg., etc.

He was president of the American Association for the Advancement of Science in 1895, and of the American Chemical Society in 1899. He was honorary chairman of the Eighth International Congress of Applied Chemistry at New York in 1912, and had been made honorary chairman of the spring meeting of the American Chemical Society that convenes at New Haven next month. In 1912 he received the Elliot Cressom medal, and in 1917 the Willard Gibbs medal was awarded to him.

Professor Morley was the son of a clergyman, and was born at Newark, N. J., Jan. 21, 1838. He was graduated at Williams College and later received honorary degrees from Yale, Lafayette and the University of Pittsburgh. In 1868 he was appointed professor of chemistry at the Western Reserve University at Cleveland, and held the post for 38 years, until his retirement in 1906. He then took up his residence at West Hartford, Conn., where he had lived with his parents as a boy.

He was married to Isabella Ashley Birdsall in 1868, whose demise preceded his by only 3 months. Immediately after her death he made a gift of $5,000 to the First Church of Christ of West Hartford in her memory, and, later he underwent a major operation at the Hartford Hospital from which he did not recover.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities
Prevailing Prices and Market Letters From Principal Industrial Centers

Problem of Maintaining Standard Prices

New Legislation Needed to Clear Up Uncertainties in Important Business Practice

One of the weighty problems facing the manufacturer is the policy of maintaining standard prices for the retail sale of his products. Can he refuse to sell to a retailer or jobber who markets his products at prices lower than the standard schedules set by the producer? Can a manufacturer decide to market his products solely through wholesale channels and then in order to maintain this policy, refuse to sell to a retailer at the jobber's price no matter what the quantity of merchandise involved? These are the questions that have been involved recently in some very important litigation — the Colgate and Beech-Nut cases before the Supreme Court and the Mennen case just decided by the United States Court of Appeals for the Second District.

These decisions, however, do not eliminate the element of uncertainty, for they do not tell the manufacturer just how far he can go in naming his own prices and thus protecting his own property. It is believed by many that the situation will not be cleared until there is definite legislation recognizing the principle of price standardization.

Proposed Legislation

When the last Congress adjourned two bills were pending that were designed to meet this situation. One of them is the Kelly-Stephens bill, originally drawn by Justice Brandeis before he became a member of the Supreme Court, and the other is the Merritt bill, introduced by Representative Merritt of Connecticut, which contains suggestions from Secretary of Commerce Hoover.

The Kelly-Stephens bill would set up machinery for price standardization to permit any independent manufacturer of a standard, identified article to file a schedule of his prices with the Federal Trade Commission. He would have authority to maintain the retail prices of his article or articles, but under section 3 of the bill the Federal Trade Commission may, on complaint of any person, investigate the standard prices so fixed to determine if they are fair. Under another section of the bill a retailer handling the standard price articles would be required to offer them for sale to the manufacturer at the price he paid for them before he would be permitted to offer them for sale to the public at prices lower than the standard fixed prices.

The Merritt bill is more simple and is confined largely to legalizing the principle of price standardization. It would permit the producer or manufacturer to fix his price and to refuse to sell to any dealer who cuts the fixed price. It provides no machinery, but if enacted into law would be rather an expression by Congress of recognition of the principle of price standardization and maintenance.

No Evidence of Price Fixing on Calcium Arsenate

Report of Federal Trade Commission Shows No Cases of Unfair Trade Practices

In its preliminary report on the calcium arsenate industry, made in pursuance to Senate Resolution 417, the Federal Trade Commission reaches the conclusion that "the evidence thus far obtained does not show that the prices (of calcium arsenate) were fixed by agreement." In the commission's detailed report a great deal of correspondence among the different manufacturers is cited and competitive conditions have been carefully analyzed. Although the producers have made a close co-operative study of prices and have discussed them at various meetings of their trade associations, there was no evidence of unfair practices such as price fixing and open-price activities.

From the facts assembled in this preliminary report, the commission submits the following conclusions:

1. That the great increase in the Southern demand for calcium arsenate and the inadequacy of the available supply of white arsenic prevented the insecticide manufacturers from producing sufficient quantities of calcium arsenate to meet this demand, the result being a marked increase in the price of white arsenic and of calcium arsenate during the seasons of 1922 and 1923.

2. The low price paid in the State of Georgia during the term of the Sherwin-Williams contract with that state was in part, at least, responsible for the opinion that an injustice was being done by the insecticide manufacturers to those customers outside the state who were paying a price as high in some cases as 100 per cent greater than that named in the abovementioned contract, an opinion which was shared by the Georgia consumers after the expiration of this contract, when they likewise had to pay similarly high prices for calcium arsenate.

3. While efforts were made by the insecticide manufacturers to establish an association one of the objects of which seems to have been adjusting or at least discussion of price discrepancies, it does not appear that these efforts resulted in price fixing or open-price activities.

4. No widespread or important specific cases of unfair practices in the trade have been found down to the present stage of the inquiry.

Fixing Standards for Naval Stores

Details of Harrison Bill to Establish Grades and Prevent Unfair Practices

During the session of Congress that ended on March 4 there was considerable discussion of naval stores, both as regards co-operative marketing and in the standardization of the many grades and varieties of these products. The Harrison bill, which passed the Senate but was not acted upon by the House, provided the establishment of standard grades of naval stores and also would make unlawful any untruthful representations in the sale or advertising of rosin and turpentine.

The various grades of rosin, from highest to lowest, are to be designated by the letters X, WW, WG, N, M, K, I, H, G F, E, D and B, together with the designation "gum rosin" or "wood rosin."

Turpentines were defined thus:

"(B) Spirits of turpentine" includes gum spirits of turpentine and wood turpentine.

"(C) Gum spirits of turpentine" means spirits of turpentine made from gum (oleoresin) from a living tree.

"(D) Wood turpentine" includes steam-distilled wood turpentine and destructively distilled wood turpentine.

"(E) Steam-distilled wood turpentine" means wood turpentine distilled with steam from the oleoresin within or extracted from the wood.

"(F) Destructively distilled wood turpentine" means wood turpentine obtained in the destructive distillation of the wood.

Fines not exceeding $5,000 and 1 year imprisonment are provided for the "use in commerce of any false, misleading, or deceitful means or practice in the sale of naval stores or anything offered as such."

Upon application, the Secretary of Agriculture would be required to make an analysis of any naval stores and certify as to their classification.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	179.51
Last week	176.76
March, 1922	156.00
March, 1921	157.00
March, 1920	252.00
April, 1918 (high)	286.00
April, 1921 (low)	140.00

A marked increase in the index number this week can be traced to the stronger markets for ammonium sulphate, cottonseed and linseed oils. Ammonium sulphate advanced to $4.15 per 100 lb., cottonseed oil to 10.5c. per lb. and linseed oil to 99c. per gal.

A. S. & R. Wipes Out Deficit

The annual report of the American Smelting & Refining Co. shows that the company's net income in 1922 after providing for general expenses, depreciation, etc., taxes and interest amounted to $5,918,142.94, an increase of $4,207,201.83 over the preceding year. After payments of dividends on preferred stock, there was a surplus of income of $2,003,112.94 at the end of 1922, compared to a deficit of $2,457,102.64 at the close of 1921. The surplus disclosed by the report is equal to earnings of approximately $3.28 on the common stock.

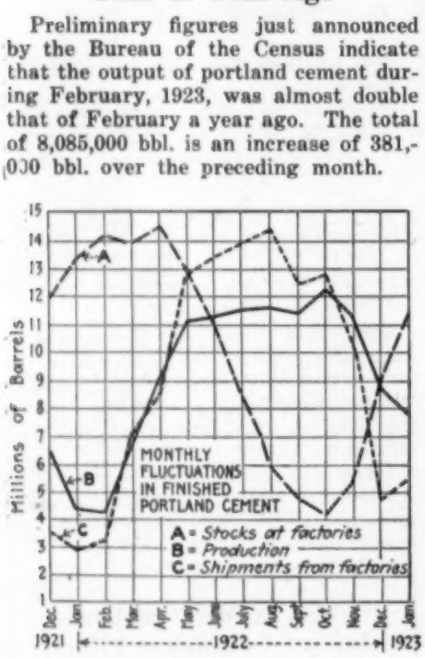
As an incident in the letter of the president of the company it is reported that the production of various important metals and the output of byproducts also showed marked improvement in 1922 over 1921 as follows:

	1922	1921
Copper (lb.)	433,548,000	348,888,...0
Silver (oz.)	84,793,931	75,354,443
Lead (ton)	252,898	207,612
Spelter (lb.)	35,[illegible]40,000	14,628,614
Sulphuric acid (lb.)	28,494,000	9,952,[illegible]00
Arsenic (lb.)	11,203,052	5,155,522
Byproduct metals (lb.)	14,[illegible]0,577	3,232,48[illegible]

The report also shows that the production of some of the above, notably spelter, sulphuric acid and arsenic and the output of byproduct metals, last year greatly exceeded their production in 1913.

Cement Production Twice That of Year Ago

Preliminary figures just announced by the Bureau of the Census indicate that the output of portland cement during February, 1923, was almost double that of February a year ago. The total of 8,085,000 bbl. is an increase of 381,000 bbl. over the preceding month.



CEMENT OUTPUT, SHIPMENTS AND STOCKS

Shipments in February totaled 5,963,000 bbl. and stocks on hand at the end of the month were 13,592,000 bbl. These may be compared with the corresponding figures for last year by means of the accompanying chart showing the monthly fluctuations in production, shipments and mill stocks throughout the country, Dec. 1, 1921, to Jan. 31, 1923.

Ammonium Sulphate Advanced by Producers in a Moderately Active Market

Difficulty in Locating Imported Goods Is Still Evident—Alkali Sales Show Improvement—Vegetable Oils Are Advanced

NEW YORK, March 19, 1923.

THE chemical market during the past week continued along moderately active lines. Sales were in most instances for small orders for immediate requirements and buyers seemed quite cautious about purchasing any surplus stocks. Existing conditions in the Ruhr district have caused a noticeable shortage of importations and several items have already been advanced by second hands. Producers of ammonium sulphate advanced prices for bulk goods at the works. Spot goods for export were also sharply advanced due to the acute scarcity of any large supplies. The alkali market showed a slight improvement and several fair-sized contracts were placed for Japan and Italy. Soda ash also recorded a fractional gain. Permanganate of potash was sharply advanced during the early part of the week, but reacted later and quotations were at the same level as previously reported.

Barium carbonate and chloride were advanced by importers, due to the shortage of shipments. Arsenic continued without any special feature and prices were unchanged. Bleaching powder producers reported a favorable market, with demand up to all expectations. Carbonate of potash was much firmer, although prices remained quotably unchanged. Caustic potash was rather unsteady and dealers were quite anxious to shade on actual business. Copper sulphate was in fair demand and producers reported an active call from the agricultural districts. Yellow prussiate of soda, formaldehyde, oxalic acid, cyanide of soda and bichromate of soda and potash continued without any notable changes.

Principal Price Changes

Alcohol—Producers reported a fair business for denatured alcohol and methanol. Second hands quoted rather low on several odd lots, but the general range for methanol 95 per cent in barrels was around $1.23 per gal. Denatured No. 1 was quoted at 38c. per gal.

Ammonium Sulphate—Leading dealers announced an advance on spot material for export. Quotations ranged around $4.15@$4.25 per 100 lb. f.a.s. for prompt shipment. Bulk material at the works was also advanced, with prices around $3.30@$3.40 per 100 lb.

Arsenic—Importers were rather unsteady and quoted fractionally lower prices on actual business. Buyers were not anxious to purchase in quantity lots at present levels and the general tone was only moderate. Quotations ranged around 15@15½c. per lb.

Barium Chloride—Importers advanced spot prices, due to the unsettled conditions abroad and the scarcity of importations. Quotations ranged around $90@$95 per ton.

Copper Sulphate—Producers reported a moderate business to the insecticide industries, with quotations at former levels. Prices range around $6.40 for 100 lb. for regular crystals.

Formaldehyde—Dealers quoted much under producers' prices, due to the unsteady consuming demand. Resale lots were around the market at 15c. per lb. Manufacturers quoted 16@16½c. per lb.

Caustic Potash—Imported material was somewhat lower on spot. Quotations were heard around 8c. per lb. on spot, with shipments at 8½c. c.i.f. N. Y., duty paid. Demand has fallen off considerably.

Carbonate of Potash—Importers were quite firm on spot material and although prices showed no material advances, round lots were very difficult to purchase at the regular quotations. The 80-85 per cent calcined held at 5¾@6c. per lb., with 96-98 per cent at 7½@8c. per lb.

Caustic Soda—The general demand continued quite steady among exporters and quotations for standard goods held around $3.45@$3.50 per 100 lb. f.a.s. Domestic traders reported a very steady market at $3.75 per 100 lb. ex-store. Contracts remained quotably unchanged.

Prussiate of Soda—Dealers were somewhat higher in their views, although actual business was not of any large dimensions. Spot stocks have been diminishing and prices ranged around 19@19½c. per lb. Shipments were around 18@18½c. per lb.

Sodium Sulphide—Spot quotations have been fractionally advanced by leading dealers. Imports have not been coming in at the rate previously noted and surplus stocks are gradually diminishing. Spot prices range around 4½@4¾c. per lb.

Phenol—Producers continued to report a well sold up condition at the works and second hands were not eager to quote any round lots. Some quotations were heard during the week at 50c. per lb. in drums.

Vegetable Oils Advanced

Linseed Oil—Several crushers announced an advance of 3c. per gal. on spot and nearby oil. There were some dealers, however, that continued to quote former levels. Quotations ranged around $1.01 per gal. in barrels for nearby shipments; 98c. per gal. for May shipments and 95@96c. per gal. for June.

Cottonseed Oil—Crude oil at the mills recorded a new advance, with quotations heard at 10¾c. per lb., tank cars, f.o.b. mill. The demand has only been moderate at the present high levels.

Improved Demand Noted in Chicago Market

Firmer Prices Generally Reported—Heavy Buying Would Cause Shortage

CHICAGO, ILL., Mar. 17, 1923.

The demand for heavy chemicals has improved considerably during the past few days and it is reported that while business was not up to desired levels it was far from dull. In regard to prices, practically all items were firm. Potash compounds in particular were exceptionally firm and nearly the entire list showed advances. So far only a few items are really scarce on spot, but even a short period of heavy buying would without a doubt create a shortage in the local market that would force prices to higher levels.

There was a better demand for alkalis during the past week and the market was firm. *Caustic soda* was quoted from spot stock at $3.50 per 100 lb. for the solid 76 per cent material and $4.15 for the ground or flake. *Caustic potash* was very firm, with the general asking price for small or moderate lots 8½@9c. per lb. basis 88-92 per cent. *Soda ash* was in good demand and the 58 per cent light was quoted at $2.25@$2.30 per 100 lb. in barrels.

Alum Demand Satisfactory

Potash alum was in moderate supply and the demand was satisfactory, according to the principal dealers. The iron-free lump was quoted at 4½@5c. per lb. and the powder of a similar grade at 7½@8c. A much better price on the powdered grade could have been had for prompt shipment from the East. *Ammonium chloride*, white granular, was in fair demand and domestic material was available at 8c. per lb. and foreign at 7½c. *Ammonium carbonate* was quiet, with only small lots available for immediate delivery. The general quoted price was 10½c. per lb., although it was possible to shade this fractionally in some directions. *Barium carbonate* was easy and it was possible to secure supplies at $85 per ton. *Barium chloride* was unchanged in price, with small quantities held for 5½c. per lb. *Carbon tetrachloride* was quiet, with nearly all dealers quoting 9½c. per lb. for large drums. *Carbon bisulphide* was in a similar position and supplies were available at 7@7½c. per lb. *Copper sulphate* was firm with an advance expected. The spot price for small or moderate lots was 6½@6¾c. per lb. *Furfural* was unchanged at 25c. per lb. *Formaldehyde* was quiet, with only small lots moving, and the price was unchanged at 16@16½c. per lb. *Glycerine* was unchanged at 18½c. per lb. for c.p. material in drums.

Phosphoric anhydride was weaker and it was possible to secure supplies at 33c. per lb. in case lots of 1-lb. tins. *Potassium bichromate* was quite firm with most factors holding the price at 13c. per lb. *Soda bichromate* was not so firm and it was possible to do 8½@9c. per lb. for moderate lots. *Potassium chlorate* was firm with only very small lots available on spot at 9½@10c. per lb. *Yellow prussiate of potash* was scarce and spot supplies were held at 41@42c. per lb. The *red prussiate* was not so firm and several factors were willing to take 85c. per lb. for a moderate lot. *Potassium permanganate* was scarce and 22@23c. per lb. for U.S.P. crystals was the best price noted. *Potassium nitrate* was slow, although the spot price was firm at 7½c. per lb. for the imported granular.

Linseed Oil and Turpentine Sluggish

Turpentine was still in poor demand and the price was somewhat lower than that of a week ago. At the close of today's market it was possible to get single drums at $1.47 per gal.

Linseed oil was in a position similar to that of turpentine and the market was a quiet affair. Single drums of the boiled oil were quoted today at $1.05 per gal. and the raw in like quantities at $1.03.

Labor Shortage Limits Steel Industry

Record Production Is Being Adequately Handled by Improved Transportation Facilities

PITTSBURGH, March 16, 1923.

The steel industry is functioning very well as to production. There are no strikes and no disability from transportation. Operation of some units is prevented by labor scarcity, but there is more employment than at any previous time in this movement.

The Steel Corporation's unfilled obligations stood at 7,283,989 tons at the end of February, indicating an increase of 373,213 tons during the month, the largest monthly increase since last September. The February increase represented about 29 per cent of the month's capacity, and taking shipments at 88 per cent, the bookings appear to have been 117 per cent, against 97 per cent in January and 73 per cent in December. The figures are not indicative of the trade current as a whole. In December the independents had relatively lean order books, and inquiry was chiefly for early delivery, the independents accordingly booking the larger part of the business going.

Generally speaking, independents are not booking business for shipment beyond July 1, for a variety of reasons. They are uncertain as to costs and market prices that may rule later, and they are doubtful whether buyers really know at this time what they will need in third quarter. The Steel Corporation's far forward bookings are chiefly in steel for construction jobs, involving little if any uncertainty as to the steel being required.

The turnover in the steel market, on the whole, is lighter. There is much inquiry, but a great deal of the inquiry is not considered by mills. There are now some developments along the line of work being postponed on account of prices, with particular reference to some tentative car buying by Western roads and a building here and there. The tonnage involved is not large, but the trend is significant. There have been practically no developments in the past week indicating that actual consumption will be heavier in the spring and summer than was to be estimated on the basis of conditions as previously known.

Premiums and Prices

Basis prices for finished steel products have not advanced in the past 2 or 3 weeks, and further general advances are improbable. Premiums for delivery may develop, but there is distinct doubt whether the premium market will be large in point of tonnage. There is premium business being done now, but it covers only an almost insignificant tonnage. Bars, shapes and plates remain at 2.25c. as the general basis, with $2 a ton more paid sometimes, and occasionally as much as $7 on plates.

Steel mills having regular customers in sheet bars will make a price of $42.50 for the second quarter, involving a large tonnage. A few consumers have no regular source of supply, and some with regular sources of supply may require extra tonnages. On such business $45 or more will probably have to be paid, there having already been $45 business done on both sheet bars and slabs. Sheet bars are thus quotable at $42.50@$45 and slabs and billets at $45.

Pig Iron and Coke

The buying movement in Connellsville furnace coke for second quarter is now practically ended, with the larger operators well sold up and with substantially all the operating furnaces, such as use purchased Connellsville coke, well covered, together with most of the idle furnaces that are at all likely to get into blast. The business totaled a trifle over 300,000 tons a month. Most of the buying was at $7, with $7.25 done on much of the later business, making an average for the whole tonnage of nearly $7.10.

Basic iron at valley furnaces has followed the advance in foundry iron reported a week ago, from $28.50 to $30, and as was the case with foundry it appears there were no sales at intermediate prices. Bessemer has advanced $1, to $30, so that the three prominent grades are all quotable at the moment at $30 valley. Furnaces are looking for higher prices, however, and some producers are out of the market. Within a week prices may be $1 or $2 higher. The furnaces seem to be comfortably sold for second quarter and it remains to be seen how well consumption is covered. There is no interest thus far in third quarter.

In all probability Lake Superior iron ore prices will be 50c. higher for the coming season, making Mesabi nonbessemer $5.55 f.o.b. dock. Such an advance, moreover, would restore the 1921 schedule and leave prices $1 below those of 1920, the modern high record.

Current Prices in the New York Market

FOR CHEMICALS, OILS AND ALLIED PRODUCTS

Although these prices are for the spot market in New York City, a special effort has been made to report the American manufacturer's quotations whenever available. In many instances these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported and resale stocks are reported when of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	$0.36 – $0.38
Acetone, drums	lb.	.22 – .23
Acid, acetic, 28%, bbl. 100	lb.	3.15 – 3.40
Acetic, 56%, bbl. 100	lb.	6.25 – 6.50
Glacial, 99½%, carboys. 100	lb.	12.00 – 12.50
Boric, crystals, bbl.	lb.	.11½ – .11¾
Boric, powder, bbl.	lb.	.11 – .11½
Citric, kegs	lb.	.49 – .50
Formic, 85%	lb.	.15 – .17
Gallic, tech.	lb.	.45 – .50
Hydrochloric, 18° tanks, 100	lb.	.90 – 1.00
Hydrofluoric, 52%, carboys	lb.	.12 – .12½
Lactic, 44%, tech., light, bbl.	lb.	.11½ – .12
22% tech., light, bbl.	lb.	.05½ – .06
Muriatic, 20°, tanks, 100	lb.	1.00 – 1.10
Nitric, 36°, carboys	lb.	.04½ – .05
Nitric, 42°, carboys	lb.	.06 – .06½
Oleum, 20%, tanks	ton	17.00 – 18.00
Oxalic, crystals, bbl.	lb.	.12½ – .13
Phosphoric, 50% carboys	lb.	.08 – .09
Pyrogallic, resublimed	lb.	1.50 – 1.60
Sulphuric, 60°, tanks	ton	9.00 – 10.00
Sulphuric, 60°, drums	ton	12.00 – 14.00
Sulphuric, 66°, tanks	ton	14.50 – 15.80
Sulphuric, 66° drums	ton	19.00 – 20.00
Tannic, U.S.P., bbl.	lb.	.65 – .70
Tannic, tech., bbl.	lb.	.40 – .45
Tartaric, imp. crys., bbl.	lb.	.30½ – .31
Tartaric, imp., powd., bbl.	lb.	.31 – .32
Tartaric, domestic, bbl.	lb.	– .32
Tungstic, per lb.	lb.	1.00 – 1.20
Alcohol, butyl, drums, f.o.b. Terre Haute	lb.	.27 – .29
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.75 – 4.95
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 188 proof No. 1	gal.	.38 – .40
Alum, ammonia, lump, bbl.	lb.	.03½ – .03¾
Potash, lump, bbl.	lb.	.03 – .03½
Chrome, lump, potash, bbl.	lb.	.05½ – .05¾
Aluminum sulphate, com., bags 100	lb.	1.50 – 1.65
Iron free bags	lb.	.02½ – .02¾
Aqua ammonia, 26°, drums	lb.	.06½ – .07½
Ammonia, anhydrous, cyl.	lb.	.30 – .30½
Ammonium carbonate, powd. casks, imported	lb.	.09½ – .10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 – .14
Ammonium nitrate, tech., casks	lb.	.10 – .11
Amyl acetate tech., drums	gal.	2.80 – 3.05
Arsenic, white, powd., bbl.	lb.	.15 – .15½
Arsenic, red, powd., kegs	lb.	.12½ – .13
Barium carbonate, bbl.	ton	78.00 – 80.00
Barium chloride, bbl.	ton	90.00 – 95.00
Barium dioxide, drums	lb.	.18 – .18½
Barium nitrate, casks		.08 – .08½
Barium sulphate, bbl.	lb.	.04 – .04½
Blanc fixe, dry, bbl.	lb.	.04 – .04½
Blanc fixe, pulp, bbl.	ton	45.00 – 55.00
Bleaching powder, f.o.b. wks., drums 100	lb.	2.20 – 2.50
Resale drums 100	lb.	2.50 – 2.75
Borax, bbl.	lb.	.05½ – .05¾
Bromine, cases	lb.	.28 – .30
Calcium acetate, bags 100	lb.	3.50 – 3.60
Calcium carbide, drums	lb.	.04½ – .04¾
Calcium chloride, fused, drums	ton	22.00 –23.00
Gran. drums	lb.	.01½ – .01¾
Calcium phosphate, mono, bbl.	lb.	.06½ – .07
Camphor, cases	lb.	.91 – .93
Carbon bisulphide, drums	lb.	.07 – .07½
Carbon tetrachloride, drums	lb.	.09½ – .10
Chalk, precip.—domestic, light, bbl.	lb.	.04½ – .04¾
Domestic, heavy, bbl.	lb.	.03½ – .03¾
Imported, light, bbl.	lb.	.04½ – .05
Chlorine, liquid, cylinders	lb.	.06 – .06½
Chloroform, tech., drums	lb.	.35 – .38
Cobalt oxide, bbl.	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks.	ton	16.50 – 20.00
Copper carbonate, bbl.	lb.	.19 – .20
Copper cyanide, drums	lb.	.47 – .50
Copper sulphate, crys., bbl., 100	lb.	6.40 – 6.50
Cream of tartar, bbl.	lb.	.24 – .25
Dextrine, corn, bags 100	lb.	3.25 – 3.50
Epsom salt, dom., tech., bbl. 100	lb.	2.00 – 2.25
Epsom salt, imp., tech., bags 100	lb.	1.10 – 1.25
Epsom salt, U.S.P., dom., bbl. 100	lb.	2.50 – 2.75
Ether, U.S.P., drums	lb.	.13 – .15
Ethyl acetate, com., 85%, drums	gal.	.80 – .85
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 – 1.00
Formaldehyde, 40%, bbl.	lb.	$0.15 – $0.16½
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00
Fullers earth—imp., powd., net	ton	30.00 – 32.00
Fusel oil, ref., drums	gal.	3.55 – 4.05
Fusel oil, crude, drums	gal.	2.30 – 2.40
Glaubers salt, wks., bags 100	lb.	1.20 – 1.40
Glaubers salt, imp., bags 100	lb.	1.00 – 1.25
Glycerine, c.p., drums extra	lb.	.18½ – .19
Glycerine, dynamite, drums	lb.	.17 – .17¼
Iodine, resublimed	lb.	4.55 – 4.65
Iron oxide, red, casks	lb.	.12 – .18
Lead:		
White, basic cabonate, dry, casks	lb.	.10 – .10½
White, in oil, kegs	lb.	.12½ – .14
Red, dry, casks	lb.	.11½ – .12
Red, in oil, kegs	lb.	.13½ – .15
Lead acetate, white crys., bbl.	lb.	.13½ – .14
Lead arsenate, powd., bbl.	lb.	.23 – .24
Lime-Hydrated, bbl.	per ton	16.80 – 17.00
Lime, Lump, bbl. 280	lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.10½ – .11
Lithophone, bbl.	lb.	.06½ – .07
Magnesium carb., tech., bags	lb.	.08 – .08½
Methanol, 95%, bbl.	gal.	1.23 – 1.25
Methanol, 97%, bbl.	gal.	1.25 – 1.27
Nickel salt, double, bbl.	lb.	.10 – .10½
Nickel salts, single, bbl.	lb.	.11 – .11½
Phosgene		.60 – .75
Phosphorus, red, cases	lb.	.35 – .40
Phosphorus, yellow, cases	lb.	.30 – .35
Potassium bichromate, casks	lb.	.10 – .10½
Potassium bromide, gran., bbl.	lb.	.16 – .23
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½ – .06
Potassium chlorate, powd.	lb.	.07 – .08
Potassium cyanide, drums	lb.	.45 – .50
Potassium hydroxide (caustic potash) drums 100	lb.	8.00 – 8.50
Potassium iodide, cases	lb.	3.65 – 3.75
Potassium nitrate, bbl.	lb.	.06½ – .07½
Potassium permanganate, drums	lb.	.20 – .21
Potassium prussiate, red, casks	lb.	.80 – .85
Potassium prussiate, yellow, casks	lb.	.37½ – .38
Salammoniac, white, gran., casks, imported	lb.	.06½ – .06¾
Salammoniac, white, gran., bbl., domestic	lb.	.08 – .08¼
Gray, gran., casks	lb.	.08½ – .08¾
Salsoda, bbl. 100	lb.	1.20 – 1.40
Salt cake (bulk)	ton	26.00 – 28.00
Soda ash, light, 58% flat, bags, contract 100	lb.	1.60 – 1.67
Soda ash, light, basis, 48%, bags, contract, f.o.b. wks. 100	lb.	1.20 – 1.30
Soda ash, light, 58% flat, bags, resale 100	lb.	1.75 – 1.80
Soda ash, dense, bags, contract, basis 48% 100	lb.	1.17½ – 1.20
Soda ash, dense, in bags, resale 100	lb.	1.85 – 1.90
Soda, caustic, 76%, solid, drums, f.a.s. 100	lb.	3.45 – 3.70
Soda, caustic, 76%, solid, drums, contract 100	lb.	3.35 3.40
Soda, caustic, basis 60%, wks., contract 100	lb.	2.50 – 2.60
Soda, caustic, ground and flake, contracts 100	lb.	3.80 – 3.90
Soda, caustic, ground and flake, resale 100	lb.	4.00 – 4.15
Sodium acetate, works, bags	lb.	.06 – .06½
Sodium bicarbonate, bbl. 100	lb.	2.00 – 2.50
Sodium bichromate, casks	lb.	.07½ – .08
Sodium bisulphate (niter cake)	ton	6.00 – 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½ – .04¾
Sodium chlorate, kegs	lb.	.06½ – .07
Sodium chloride long	ton	12.00 – 13.00
Sodium cyanide, cases	lb.	.20 – .23
Sodium fluoride, bbl.	lb.	.09 – .10
Sodium hyposulphite, bbl.	lb.	.03 – .03½
Sodium nitrite, casks	lb.	.08½ – .09
Sodium peroxide, powd., cases	lb.	.28 – .30
Sodium phosphate, dibasic, bbl.	lb.	.03½ – .04
Sodium prussiate, yel. drums	lb.	.19 – .19½
Sodium silicate (40°, drums) 100	lb.	.80 – 1.15
Sodium silicate (60°, drums) 100	lb.	2.00 – 2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04½ – .04¾
Sodium sulphite, crys., bbl.	lb.	.03¼ – .03½
Strontium nitrate, powd., bbl.	lb.	.09½ – .10
Sulphur chloride, yel drums	lb.	.04½ – .05
Sulphur, crude	ton	18.00 – 20.00
Sulphur dioxide, liquid, cyl.	lb.	.08 – .08¼
Sulphur, flour, bbl. 100	lb.	2.35 – 3.15
Sulphur, roll, bbl. 100	lb.	$2.00 – $2.50
Tale—imported, bags	ton	30.00 – 40.00
Tale—domestic powd., bags	ton	18.00 – 25.00
Tin bichloride, bbl.	lb.	.13½ – .14
Tin oxide, bbl.	lb.	.52 – .54
Zinc carbonate, bags	lb.	.14 – .14½
Zinc chloride, gran, bbl.	lb.	.06 – .07
Zinc cyanide, drums	lb.	.37 – .38
Zinc oxide, XX, bbl.	lb.	.07½ – .08
Zinc sulphate, bbl. 100	lb.	2.75 – 3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.80 – $0.85
Alpha-naphthol, ref., bbl.	lb.	1.05 – 1.10
Alpha-naphthylamine, bbl.	lb.	.38 – 40
Aniline oil, drums	lb.	.16½ – .17
Aniline salts, bbl.	lb.	.24 – .25
Anthracene, 80%, drums	lb.	.75 – 1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.65 – .70
Anthraquinone, 25%, paste, drums	lb.	.70 – .75
Benzaldehyde U.S.P., carboys	lb.	1.40 – 1.45
Benzene, pure, water-white, tanks and drums	gal.	.30 – .35
Benzene, 90%, tanks & drums	gal.	.26 – .32
Benzene, 90%, drums, resale	gal.	.33 – .35
Bensidine base, bbl.	lb.	.85 – .90
Benzidine sulphate, bbl.	lb.	.75 – .80
Benzoic acid, U.S.P., kegs	lb.	.72 – .75
Benzoate of soda, U.S.P., bbl.	lb.	.57 – .65
Benzyl chloride, 95-97%, ref., drums	lb.	.25 – .27
Benzyl chloride, tech., drums	lb.	.20 – .23
Beta-naphthol, subl., bbl.	lb.	.55 – .60
Beta-naphthol, tech., bbl.	lb.	.24 – .25
Beta-naphthylamine, tech.	lb.	.80 – .90
Carbazol, bbl.	lb.	.75 – .90
Cresol, U.S.P., drums	lb.	.25 – .29
Ortho-cresol, drums	lb.	.24 – .26
Cresylic acid, 97%, resale, drums	gal.	1.40 – 1.50
95-97%, drums, resale	gal.	1.40 – 1.50
Dichlorbensene, drums	lb.	.07 – .09
Diethylaniline, drums	lb.	.50 – .60
Dimethylaniline, drums	lb.	.41 – .42
Dinitrobensene, bbl.	lb.	.19 – .20
Dinitroclorbensene, bbl.	lb.	.22 – .23
Dinitronaphthalene, bbl.	lb.	.30 – .32
Dinitrophenol, bbl.	lb.	.35 – .40
Dinitrotoluene, bbl.	lb.	.20 – .22
Dip oil, 25%, drums	gal.	.25 – .30
Diphenylamine, bbl.	lb.	.50 – .52
H-acid, bbl.	lb.	.80 – .85
Meta-phenylenediamine, bbl.	lb.	.95 – 1.00
Michlers ketone, bbl.	lb.	3.00 – 3.50
Monochlorbensene, drums	lb.	.08 – .10
Monoethylaniline, drums	lb.	.95 – 1.10
Naphthalene, crushed, bbl.	lb.	.06 – .06½
Naphthalene, flake, bbl.	lb.	.07½ – .08
Naphthalene, balls, bbl.	lb.	.08½ – .09
Naphthionate of soda, bbl.	lb.	.58 – .65
Naphthionic acid, crude, bbl.	lb.	.60 – .65
Nitrobensene, drums	lb.	.10 – .12
Nitro-naphthalene, bbl.	lb.	.30 – .35
Nitro-toluene, drums	lb.	.15 – .17
N-W acid, bbl.	lb.	1.15 – 1.20
Ortho-amidophenol, kegs	lb.	2.30 – 2.35
Ortho-dichlorbensene, drums	lb.	.17 – .20
Ortho-nitrophenol, bbl.	lb.	.90 – .92
Ortho-nitrotoluene, drums	lb.	.10 – .12
Ortho-toluidine, bbl.	lb.	.13 – .15
Para-amidophenol, base, kegs	lb.	1.15 – 1.20
Para-amidophenol, HCl, kegs	lb.	1.20 – 1.25
Para-dichlorbensene, bbl.	lb.	.17 – .20
Paranitraniline, bbl.	lb.	.74 – .75
Para-nitrotoluene, bbl.	lb.	.55 – .65
Para-phenylenediamine, bbl.	lb.	1.45 – 1.50
Para-toluidine, bbl.	lb.	.90 – .95
Phthalic anhydride, bbl.	lb.	.35 – .38
Phenol, U.S.P., drums	lb.	.50 – .55
Picric acid, bbl.	lb.	.20 – .22
Pyridine, dom., drums	gal.	nominal
Pyridine, imp., drums	gal.	2.30 – 2.50
Resorcinol, tech., kegs	lb.	1.50 – 1.55
Resorcinol, pure, kegs	lb.	2.00 – 2.10
R-salt, bbl.	lb.	.60 – .65
Salicylic acid, tech., bbl.	lb.	.40 – .42
Salicylic acid, U.S.P., bbl.	lb.	.45 – .47
Solvent naphtha, water-white, drums	gal.	.37 – .40
Crude, drums	gal.	.22 – .24
Sulphanilic acid, crude, bbl.	lb.	.18 – .20
Thiocarbanilide, kegs	lb.	.35 – .38
Toluidine, kegs	lb.	1.20 – 1.30
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars	gal.	.35 – .37
Toluene, drums	gal.	.40 – .43
Xylidines drums	lb.	.40 – .45
Xylene, pure, drums	gal.	.45 – .50
Xylene, com., drums	gal.	.40 – .42
Xylene, com., tanks	gal.	.30 – .....

Naval Stores

Rosin B-D, bbl.	280 lb.	$6.15 –	
Rosin E-I, bbl.	280 lb.	6.25 –	$6.40
Rosin K-N, bbl.	280 lb.	6.55 –	6.95
Rosin W.G.-W.W., bbl.	280 lb.	7.35 –	8.05
Wood rosin, bbl.	280 lb.	6.25 –	
Turpentine, spirits of, bbl.	gal.	1.52 –	1.53
Wood, steam dist., bbl.	gal.	1.35 –	
Wood, dest. dist., bbl.	gal.	1.25 –	
Pine tar pitch, bbl.	200 lb.	–	6.00
Tar, kiln burned, bbl.	500 lb.	–	12.00
Retort tar, bbl.	500 lb.	–	11.00
Rosin oil, first run, bbl.	gal.	.43 –	
Rosin oil, second run, bbl.	gal.	.47 –	
Rosin oil, third run, bbl.	gal.	.53 –	
Pine oil, steam dist.	gal.	–	.90
Pine oil, pure, dest. dist.	gal.	–	.85
Pine tar oil, ref.	gal.	–	.46
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	–	.35
Pine tar oil, double ref., bbl.	gal.	–	.75
Pine tar, ref., thin, bbl.	gal.	–	.25
Pinewood creosote, ref., bbl.	gal.	–	.52

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$.13½ –	$.13¾
Castor oil, AA, bbl.	lb.	.14 –	.14½
Chinawood oil, bbl.	lb.	.22½ –	.23
Coconut oil, Ceylon, bbl.	lb.	.10½ –	.10¾
Coconut oil, Cochin, bbl.	lb.	.10½ –	
Corn oil, crude, bbl.	lb.	.12¼ –	
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.10½ –	
Summer yellow, bbl.	lb.	.12¼ –	.12½
Winter yellow, bbl.	lb.	.13 –	.13¼
Linseed oil, raw, car lots, bbl.	gal.	1.01 –	
Raw, tank cars (dom.)	gal.	.96 –	
Boiled, 5-bbl. lots (dom.)	gal.	1.05 –	
Olive oil, denatured, bbl.	gal.	1.10 –	1.15
Palm, Lagos, casks	lb.	.08¼ –	.08½
Palm kernel, bbl.	lb.	.09½ –	
Peanut oil, crude, tanks (mill)	lb.	.13½ –	.13¾
Peanut oil, refined, bbl.	lb.	.17 –	
Rapeseed oil, refined, bbl.	gal.	.85 –	.86
Rapeseed oil, blown, bbl.	gal.	.90 –	.91
Soya bean (Manchurian), bbl.	lb.	.12¼ –	
Tank, f.o.b. Pacific coast	lb.	.10½ –	

Fish Oils

Menhaden, light pressed, bbl.	gal.	$0.70 –	
White bleached, bbl.	gal.	.72 –	.74
Blown, bbl.	gal.	.76 –	.78
Whale No. 1 crude, tanks, coast	lb.	.06½ –	

Dye & Tanning Materials

Divi-divi, bags	ton	$38.00 –	$39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	28.00 –	30.00
Logwood, chips, bags	lb.	.02½ –	.03½
Sumac, leaves, Sicily, bags	ton	65.00 –	
Sumac, ground, bags	ton	55.00 –	60.00
Sumac, domestic, bags	ton	35.00 –	
Tapioca flour, bags	lb.	.03½ –	.05

EXTRACTS

Archil, cone., bbl.	lb.	$0.17 –	$0.18
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08 –	.09
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.04 –	.05
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.14 –	.17
Logwood, crys., bbl.	lb.	.19 –	.20
Logwood, liq., 51°, bbl.	lb.	.09 –	.10
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.05
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07

Waxes

Bayberry, bbl.	lb.	$0.28 –	$0.30
Beeswax, refined, dark, bags	lb.	.30 –	.32
Beeswax, refined, light, bags	lb.	.34 –	.35
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.25 –	.27
Carnauba, No. 1, bags	lb.	.40 –	.41
No. 2, North Country, bags	lb.	.23½ –	.24
No. 3, North Country, bags	lb.	.19 –	.19½
Japan, cases	lb.	.15 –	.15½
Montan, crude, bags	lb.	.04 –	.04½
Paraffine, crude, match, 105-110 m.p.	lb.	.04 –	.04½
Crude, scale 124-126 m.p., bags	lb.	.02½ –	.03
Ref., 118-120 m.p., bags	lb.	.03½ –	.03¾
Ref., 125 m.p., bags	lb.	.03½ –	.03¾
Ref. 128-130 m.p., bags	lb.	.04 –	.04½
Ref., 133-135 m.p., bags	lb.	.04½ –	.04¾
Ref., 135-137 m.p., bags	lb.	.05 –	.05½
Stearic acid, sgle pressed, bags	lb.	.14 –	
Double pressed, bags	lb.	.14½ –	
Triple pressed, bags	lb.	.16 –	

Fertilizers

Ammonium sulphate, bulk, f.o.b. works	100 lb.	$3.30 –	$3.40
F.a.s. double bags	100 lb.	4.15 –	4.25
Blood, dried, bulk	unit	4.60 –	
Bone, raw, 3 and 50, ground	ton	30.00 –	35.00
Fish scrap, dom., dried, wks.	unit	5.00 –	5.10
Nitrate of soda, bags	100 lb.	2.62½ –	2.65
Tankage, high grade, f.o.b. Chicago	unit	4.70 –	4.80
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	35.00 –	36.00
Potassium sulphate, bags	unit	1.00 –	

Crude Rubber

Para—Upriver fine	lb.	$0.33 –	$0.33½
Upriver coarse	lb.	.27½ –	.28
Upriver caucho ball	lb.	.29 –	.30
Plantation—First latex crepe	lb.	.34½ –	.35
Ribbed smoked sheets	lb.	.34½ –	.35
Brown crepe, thin, clean	lb.	.31 –	.32
Amber crepe No. 1	lb.	.31 –	.32

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$450.00 –	$550.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	60.00 –	80.00
Asbestos, cement, f.o.b., Quebec	sh. ton	15.00 –	17.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	24.00 –	28.00
Barytes, crude f.o.b. mines, bulk	net ton	9.00 –	9.25
Casein, bbl., tech.	lb.	.11 –	.12
China clay (kaolin) crude, f.o.b. Ga.	net ton	7.00 –	9.00
Washed, f.o.b. Ga.	net ton	8.00 –	9.00
Powd., f.o.b. Ga.	net ton	13.00 –	20.00
Crude f.o.b. Va.	net ton	8.00 –	12.00
Ground, f.o.b. Va.	net ton	13.00 –	20.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	6.00 –	7.00
No. 2 pottery	long ton	5.00 –	5.50
No. 1 soap	long ton	7.00 –	7.50
No. 1 Canadian, f.o.b. mill	long ton	25.00 –	27.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	.06 –	.06½
Ceylon, chip, bbl.	lb.	.05 –	.05½
High grade amorphous crude	ton	35.00 –	50.00
Gum arabic, amber, sorts, bags	lb.	.15 –	.16
Gum tragacanth, sorts, bags	lb.	.50 –	.60
No. 1, bags	lb.	1.75 –	1.80
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N. Y.	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl.	lb.	.05 –	.05½
Dom., ground, bbl.	lb.	.06 –	.07
Shellac, orange fine, bags	lb.	.82 –	.83
Orange superfine, bags	lb.	.84 –	.85
A. C. garnet, bags	lb.	.79 –	.80
T. N., bags	lb.	.80 –	.81
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00 –	17.50
Silica, bldg. sand, f.o.b. Pa.	ton	2.00 –	2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 –	20.00

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40–46
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11½	.11¾
4-6% C	lb.	.12 –	.13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	110.00 –	112.00
Spiegeleisen, 19-21% Mn.	gr. ton	35.00 –	37.00
Ferromolybdenum, 50-60% Mo, per lb Mo	lb.	1.90 –	2.15
Ferrosilicon, 10-15%	gr. ton	38.00 –	40.00
50%	gr. ton	86.00 –	89.00
75%	gr. ton	150.00 –	160.00
Ferrotungsten, 70-80%, per lb. of W	lb.	$0.85 –	$0.90
Ferro-uranium, 35-50% of U. per lb. of U	lb.	6.00 –	
Ferrovanadium, 30-40%, per lb. of V	lb.	3.75 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$6.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	18.50 –	19.00
Coke, fdry., f.o.b. ovens	ton	8.25 –	8.50
Coke, furnace, f.o.b. ovens	ton	7.00 –	7.25
Fluorspar, gravel, f.o.b. mines' Illinois	ton	21.50 –	
Ilmenite, 52% TiO_2	lb.	.01½ –	.01¾
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.33 –	
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 –	.70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl seaport	unit	.11½ –	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	
Rutile, 95% TiO_2	lb.	.12 –	
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 –	8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 –	8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.04½ –	.13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	16.75–17.00
Aluminum, 98 to 99%	25.00–25.50
Antimony, wholesale, Chinese and Japanese	8.75–9.00
Nickel, virgin metal	25.00–27.00
Nickel, ingot and shot	29.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	50.00
Lead, New York, spot	8.25
Lead, E. St. Louis, spot	8.25
Zinc, spot, New York	8.00–8.10
Zinc, spot, E. St. Louis	7.70–7.85

OTHER METALS

Silver (commercial)	oz.	$0.67
Cadmium	lb.	1.10
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	2.65@2.85
Magnesium, ingots, 99%	lb.	1.00@1.05
Platinum	oz.	110.00
Iridium	oz.	260.00@275.00
Palladium	oz.	79.00
Mercury	75 lb.	69.00@70.00

FINISHED METAL PRODUCTS

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	20.75
Copper bottoms	30.25
Copper rods	20.50
High brass wire	19.50
High brass rods	17.00
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	25.25
Seamless high brass tubing	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	11.30@11.50
Copper, heavy and wire	11.25@11.50
Copper, light and bottoms	9.25@ 9.50
Lead, heavy	5.75@ 6.00
Lead, tea	3.50@ 3.75
Brass, heavy	6.25@ 6.40
Brass, light	5.35@ 5.75
No. 1 yellow brass turnings	6.30@ 6.50
Zinc	3.50@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.29	$3.14
Soft steel bars	3.19	3.04
Soft steel bar shapes	3.19	3.04
Soft steel bands	3.29	3.19
Plates, ¼ to 1 in. thick	3.29	3.14

Industrial

Financial. Construction and Manufacturers' News

Construction and Operation

Alabama

HOLT—The Central Foundry Co. will immediately commence erection of a new 1-story foundry, 140x365 ft., for the manufacture of cast-iron pipe for heavy pressure service, 2 to 18 in. in diameter. Headquarters are at 41 East 42nd St., New York.

BIRMINGHAM—A 1-story foundry will be erected at the plant of the Birmingham Machine & Foundry Co., 11th Ave., to be used for the production of iron castings. It will cost about $12,000, exclusive of equipment.

California

BAY POINT—The West Coast Chemical Co., 77 O'Farrell St., San Francisco, has leased a portion of the local plant of the Pacific Coast Shipbuilding Co. for the establishment of a temporary factory for the manufacture of sulphur specialties as used in the rubber industry, and chemical byproducts. A 5-acre tract of land has been secured in this same section, and at an early date it is purposed to commence the erection of a large plant, at which time the temporary works will be abandoned. F. A. Somers and H. R. Bostwick head the company.

FULLERTON—The Orange County Brick & Tile Co., recently organized, has acquired property from the Moore Brothers Sand Co. as a site for a new plant for the manufacture of brick, tile and affiliated burned clay products. The works will be equipped for an initial production of about 40,000 bricks per day, and are estimated to cost approximately $50,000, with machinery. The company is headed by F. C. Krause, J. W. Carmichael and J. J. Lilley.

SAN DIEGO—The Union Oil Co., Union Oil Bldg., Los Angeles, has acquired property at San Diego, and plans for the erection of a new storage and distributing plant, with initial capacity of about 80,000 gal.

REDLANDS—The Jones Vinegar Co. has tentative plans under consideration for extensions in its plant to double approximately the present capacity. The company is a recent industry, having been operating since last fall.

SAN FRANCISCO—The Banner Refining Co., Kohl Bldg., is arranging for the immediate erection of a new plant in the vicinity of Seattle, Wash., to cost about $175,000. Plans are also being considered for an oil refinery in southern California or Arizona, to cost approximately a like amount.

RICHMOND—The Pacific Sanitary Mfg. Co., manufacturer of sanitary fixtures, has commenced the erection of an addition to its plant at California, 5th and Hensley Sts., estimated to cost approximately $150,000, with equipment.

Connecticut

BRIDGEPORT—The Contract Plating Co., 725 North Washington Ave., is planning for the installation of laboratory equipment for chemical and other service. R. J. O'Connor is in charge.

WINDSOR LOCKS—C. H. Dexter & Sons, manufacturers of paper products, have taken bids on a general contract and plan for the early erection of a 4-story and basement addition, 54x100 ft., to be used for the most part as a beater department. Greenwood & Noerr, 847 Main St., Hartford, Conn., are consulting engineers.

Illinois

CHICAGO—The Plunkett Chemical Co., 2940 South Park Ave., has purchased property at 35th and Morgan Sts., 116x160 ft., improved with a 4-story and basement building totaling about 60,000 sq.ft., for a consideration of about $100,000, and plans for the immediate establishment of a new plant. It is purposed to remove the present works to the new location, following repairs and improvements in the structure.

CHICAGO—Gutmann & Co., 1511 Webster St., leather tanners, will soon take bids on a general contract for the erection of a 4-story addition to their tannery, estimated to cost $50,000. I. S. Stein, 35 South Dearborn St., is architect.

CHICAGO—The Asbestos Products Co., 220 South La Salle St., has purchased the factory of the General Combustion Co., at 2100 Fullerton St., from L. L. Mullins, receiver, for a new plant. The site aggregates 150x170 ft., with 1-story and basement building, 50x100 ft. The property was secured for a consideration of $41,000. Machinery will be installed at an early date.

Iowa

SIOUX CITY—The Sioux City Brick & Tile Co., 9 West 3rd St., has awarded a general contract to William Klinger, Warnock Bldg., for the erection of a new plant consisting of seven buildings, estimated to cost about $100,000. The main structure, to be used for operating machinery, will be 5-story, 60x80 ft.; the other buildings, all 1-story, will be 44x136 ft., 45x126 ft., 60x60 ft., 38x60 ft., 38x44 ft., and 24x52 ft. Work will be commenced at once. D. P. Mahoney is president and general manager.

Kentucky

CARTER—The Ashland Limestone Co. has plans under consideration for the installation of additional equipment at its plant, including power house. The company has a tract of 100 acres of land, and plans for extensive output. M. E. S. Poseg, P. O. Box 668, Ashland, Ky., is manager and engineer.

LEXINGTON—The board of directors, State University of Kentucky, has commissioned Coolidge & Shattack, Ames Bldg., Boston, Mass., architects, to prepare plans for a 2-story and basement addition, 56x110 ft., to the chemistry building at the institution, estimated to cost approximately $80,000. Frank McVey is president.

OWENSBORO—Bolger & Medley have plans in preparation for the construction of a new local plant for the manufacture of brick and tile products, estimated to cost $60,000.

Maryland

BALTIMORE—The Maryland Glass Corp., Linden and Ontario Sts., will immediately commence the erection of a 1-story addition to its plant, 40x120 ft., estimated to cost $25,000. A general building contract has been let to the Austin Co., Bulletin Bldg., Philadelphia, Pa.

ELKTON — The Beacon Hill Brick Co., recently organized with a capital of $80,000, is perfecting plans for the operation of a new plant in the Beacon Hill section for the manufacture of brick and tile products. Equipment will be provided for an initial working force of about 35 men. John Mattiuse and James F. Evans, Elkton, head the company.

HANCOCK—The Maryland Glass Sand Co. has plans under way for extensions and improvements in its plant for considerable increase in capacity. It is purposed to electrify the complete works, and equipment for this purpose will be installed. The company has recently arranged for an increase in capital from $150,000 to $250,000 for expansion.

BALTIMORE — The Prudential Oil Corp., Fairfield, has taken title to a tract of land, 161x945 ft., heretofore held by the United States Industrial Alcohol Co., for a consideration of $23,500, and will use the site for the construction of a new oil storage and distributing plant.

Massachusetts

HOLYOKE—The Judd Paper Co., 166 Race St., is considering plans for the erection of a new building at its plant to cost about $75,000. George P. B. Alderman & Co., 316 High St., Holyoke, is architect.

Michigan

LANSING—The Briggs Co., manufacturer of brick and other burned clay products, with plants at Grand Rapids and Grand Ledge, Mich., has acquired the local works of the Clippert & Spaulding Co., with rated capacity of about 70,000 face brick per day. Immediate possession will be taken and plans developed for increased output. It is purposed to install additional machinery to double, approximately, the present capacity.

DETROIT—Contract has been awarded to the Austin Co., Penobscot Bldg., for the erection of a 1- and 2-story foundry at the plant of the United States Radiator Co., Campbell Ave., estimated to cost $104,000, with equipment. It will be devoted to the production of iron castings.

MUSKEGON—The Central Paper Co. has work under way on two additional buildings at its plant, to be used for general manufacturing. The structures will cost in excess of $50,000.

Minnesota

MINNEAPOLIS—The Diamond Steel Products Co., 1414 Marshall St., is perfecting plans for the erection of a new 2-story plant addition. George C. Bouthinon is one of the heads of the company in charge.

New Hampshire

EAST JAFFREY — The New Hampshire Match Co., Keene, N. H., is arranging for the early installation of machinery at its new local plant now in course of completion. It will be 1-story, 50x148 ft. and estimated to cost approximately $25,000, exclusive of equipment. L. F. Dickenson heads the company.

New Jersey

NEWARK—The Eastern Steel Castings Co., a subsidiary of the American Brake Shoe & Foundry Co., 30 Church St., New York, has taken over the plant of the parent company at Ave. L and Edwards St., Newark, comprising three main buildings, 230x480 ft., 60x230 ft. and 60x200 ft., on large tract of land. The plant will be used for the production of steel castings, and will be equipped to develop a total output of 1,000 tons per month. The Eastern company recently acquired the plant and business of the Bayonne Steel Casting Co., Oak St., Bayonne, N. J., and will remove this works to the new location. William D. Sargent, formerly head of the Bayonne company, will be president of the Eastern organization.

BLOOMSBURY—The Bloomsbury Graphite Co. has authorized the immediate rebuilding of its local plant devoted to the manufacture of graphite products, foundry facings, etc., recently destroyed by fire with loss of about $40,000. New grinding and other machinery will be installed to double the former capacity.

NEWARK—H. F. Sommer & Co., 219 Wilson Ave., operating a leather tannery, will build a 1-story addition to their plant at 12-16 Paris St., including improvements in the present structure, estimated to cost $15,000.

BAYONNE—The Tide Water Oil Co., 11 Broadway, New York, has filed plans for the erection of a new building at its local refinery and additional tanks, estimated to cost $25,000.

New York

BROOKLYN — Plans are being completed and bids will soon be asked for the erection of a 2-story addition, 54x100 ft., to the plant of Abraham Werbelovsky, 83 Meserole St., manufacturer of glass products to be located at 57-59 Scholl St., estimated to cost close to $40,000. Harry J. Nurick, 44 Court St., is architect.

BUFFALO—Spencer Kellogg & Sons, Delaware St., manufacturers of linseed, core and other oils, will build a new addition to their plant at Michigan and Ganson Sts., to cost about $12,000. It will be used for general operating service.

NORTH TONAWANDA—The Herschell-Spillman Motor Co., Sweeney St., is planning for the immediate rebuilding of the portion of its heat-treating department, damaged by fire March 4. An official estimate of loss has not been made.

North Carolina

FOUR OAKS—The Meadow Brick Co., recently organized with a capital of $25,000, has tentative plans under consideration for the installation of additional equipment of develop a maximum output in excess of 75,000 bricks per day. New clay loading machinery will be purchased. J. W. Sanders is president, and W. H. Smith, secretary and treasurer.

Ohio

EAST PALESTINE—The W. S. George Pottery Co., manufacturer of general ware, has completed plans and will break ground at

once for the erection of a 2-story addition, 156x400 ft., on site of the old East Palestine pottery, destroyed by fire some time ago. A tunnel kiln will be installed in the new plant, which is estimated to cost close to $300,000, with equipment. Facilities will be provided for the employment of about 400 operatives. W. S. George heads the company.

COLUMBUS—H. C. Godman, 35th St., has plans nearing completion for the erection of a new plant at West State and Lucas Sts., to be equipped for the manufacture of leatherboard products. Richards, McCarty & Bulford, 584 East Broad St., are architects.

Pennsylvania

MARTIN'S CREEK — The Alpha Portland Cement Co., Easton, Pa., will make extensions and improvements in its local mill, including the installation of a new power plant and waste heat equipment, the latter to provide for more economical operation. Other apparatus will also be purchased. The company has arranged an appropriation in excess of $1,000,000 for extensions and betterments in its other mills in different parts of the country.

HAZLETON—The Hazleton Iron Works Co. has tentative plans under consideration for the rebuilding of the portion of its iron foundry, recently destroyed by fire with loss approximating $50,000, including equipment.

YORK—The Emigsville Lime & Shale Co., Emigsville, near York, has preliminary plans in progress for the rebuilding of the portion of its plant destroyed by fire March 8. An official estimate of loss of buildings and machinery has not been announced.

HILLSVILLE—Fire, March 2, caused by an explosion, destroyed a portion of the Quaker Falls plant of the Grasselli Powder Co., near Hillsville, with loss estimated at $14,000. It is planned to rebuild.

Texas

LUBBOCK—The Lubbock Cotton Oil Co., recently organized with a capital of $150,000, has plans nearing completion for the erection of a new local plant to cost about $100,000, including machinery. Bids will soon be asked. G. A. Simmons is general manager.

SMITH'S BLUFF—The Pure Oil Co., Pure Oil Bldg., Columbus, O., is perfecting plans for the erection of a new refining plant on local site, recently acquired. It will have a capacity of 10,000 bbl. per day, and will include a gasoline refinery, with 26 "cracking" process units. It is estimated to cost in excess of $300,000, including machinery.

PORT ARTHUR — The Gulf Refining Co., Frick Annex, Pittsburgh, Pa., has arranged an appropriation of more than $16,000,000 for extensions and improvements in its local oil refinery. The work will include an addition to the main plant, with 94 oil stills; extension to the chloride process department used for gasoline production; addition to the sulphuric acid works to provide a total capacity of about 100 tons per day; new grease and compounding plant, with total floor area of about 100,000 sq.ft.; new power and pumping machinery for different operating departments; new electric power plant of 10,000 kw. capacity and steam power house of 6,000-hp. rating; can manufacturing works and additions to tankage department, the latter including 66 new steel tanks and auxiliary equipment with capacity of 500,000 bbl. The company will also build an addition to concrete wharf. George V. Taber is vice-president in charge.

BRECKENRIDGE—The Acme Brick Co., Fort Worth, Tex., has tentative plans under consideration for the construction of a new plant at Breckenridge. A site is being selected. W. R. Brennt is president.

WACO—The Waco Lime & Products Co., formerly known as the Koury Calcium Co., McGregor, Tex., has work under way on a new local lime plant with capacity of about 100 tons a day. A hydrator and other equipment will be provided for larger output in the near future. John L. Spurlin, Jr., Waco, is secretary.

Virginia

ROANOKE—The Roanoke Tire & Rubber Co., Terry Bldg., has commissioned B. F. Mitchell, Seaboard Bank Bldg., architect, to prepare plans for its proposed new 3-story plant in the West End section, 50x130 ft., for the manufacture of tires and other rubber products. Alfred Buck is head of the company, in charge.

West Virginia

NEWELL—The Homer Laughlin China Co. is completing plans for the erection of a new plant unit on the old golf links, Ohio River, to consist of a main 1-story structure, 220x800 ft., estimated to cost in excess of $600,000, with machinery. Three tunnel kilns, Harrop type, will be constructed, one to be used for bisque ware, another for glost material and the third for decorating service. Work will be commenced at an early date. Marcus Aaron is president.

PARKERSBURG—The plant of the Parkersburg Brick Co. has been acquired by the Citizens' Lumber Co., consisting of about 10 acres of land in the Lee's Hill section. The new owner will continue the operation of the plant and has plans in progress for the erection of a new works on adjoining site, with daily capacity of about 75,000 bricks, estimated to cost $100,000, with machinery.

Wisconsin

STEVENS POINT—The Consolidated Water Power & Paper Co. has completed plans and will soon break ground for the construction of a 2-story addition to its local mill, estimated to cost approximately $150,000, with machinery. L. A. De Guers, Wood Block, Wisconsin Rapids, is engineer. George W. Mead heads the company.

Industrial Developments

LEATHER — The Endicott-Johnson Co., Endicott and Johnson City, N. Y., is maintaining capacity production at practically all of its tanneries, giving employment to full working forces. The sole leather tannery has a production of over 6,000 sides of leather per day, with employment of 450 operatives; the chrome leather tannery at Endicott has a daily output of 1,500 sides, giving work to 100 persons; the chrome sole tannery at this same place is also giving employment to about 100 workers, under a capacity schedule of 2,000 sides of leather daily; the new upper leather tanning plant at Endicott is employing 200 operatives, with a rated output of 1,800 sides per day, while the other tannery of this same character here is running on a basis of 3,800 sides daily, with employment of 400 workers; the calfskin tannery of the company produces about 5,000 sides of leather per day, with employment of 650 operatives.

Dungan, Hood & Co., Philadelphia, Pa., specializing in the production of glazed kid leathers, are operating at about 75 per cent of capacity.

Tolman, Dow & Co., Inc., Woburn, Mass., is operating at regular capacity at its local tannery, with bulk of output devoted to brown leathers.

GLASS — The Owens Bottle Co., South Glassboro, N. J., is running at the highest capacity possible with existing working force, and is said to be seeking additional operatives. The plant has orders on hand for some time to come.

The Carr-Lowrey Glass Co., Westport, Md., is maintaining production at its local plant, devoted to hollow ware specialties, with full working force, and a recent fire at the works, caused by the bursting of a 20-ton mixing vat of molten glass, will not cause any suspension in operations.

The Illinois Glass Co., Bridgeton, N. J., is operating at its new local machine-blowing plant and adding additional workers to the force. It is expected to develop capacity production at an early date.

The majority of the glass plants in the vicinity of Millville, Salem and Vineland, N. J., are operating at capacity, with full working forces, and expect to continue on this basis throughout the spring and well into the summer.

CERAMIC—The Gem Clay Works, Sebring, O., are running at maximum capacity with full working force. Plans are being developed to double the present output and a number of additions will be constructed.

The Elk Fire Brick Co., Renovo, Pa., is operating under heavy production and will maintain this schedule for an indefinite period. Plans are in progress for the establishment of a housing development for employees.

The Wellsville Fire Brick Co., Wellsville, Mo., is maintaining capacity operations and heavy shipments are leaving the plant. A full working force is being employed. It is expected to advance production with the installation of additional equipment, giving employment to an increased number of workers.

The Pennsylvania Clay Co. is arranging for the immediate resumption of operations at its Conway, Pa., plant, devoted to the production of paving brick. It is expected to develop an output of about 60,000 bricks per day. The plant has been closed recently for repairs and improvements.

IRON AND STEEL—The Joseph E. Thropp Co., Inc., Cumberland, Md., recently succeeding to the blast furnace and iron properties of Joseph E. Thropp, has improvement and repair work in progress at the stack, and plans to blow in at an early date. The furnace has been idle for some months past. Operations are also being resumed at the coke ovens and limestone quarries of the company.

The Eastern Steel Co., Pottsville, Pa., is advancing operations at its local plant and additional open-hearth furnaces will soon be lighted. Part of the works will be placed on a double turn at once, giving employment to an increased operating force.

The McKinney Steel Co., Cleveland, O., has resumed operations at its two furnaces at Josephine, near Blairsville, Pa., following a suspension for about 24 months. It is expected to maintain production for an indefinite period, giving employment to a large working quota. The company is planning to blow in its furnace on the Genesee River, near Rochester, N. Y., early in April, and the stack is being made ready.

E. J. Lavino & Co., Philadelphia, Pa., has blown in its blast furnace at Lebanon, Pa., after a suspension for nearly 2 years. This makes the second stack of the company in Bethlhem County in service. All five stacks of the Bethlehem Steel Co., in this same county, are still inactive.

The Carnegie Steel Co., Sharon, Pa., is making ready to apply the torch to its No. 4 blast furnace here, after an idleness of about 36 months. With this stack in service, all furnaces of the company will be producing for the first time since April, 1920. Throughout the Pittsburgh district, 49 of the 59 furnaces of the company are now on the active list.

Steel mills in the vicinity of Birmingham, Ala., are running at capacity, with full working forces. The Gulf States Steel Co., is at maximum output at its Gadsden, Ala., works and has recently advanced the wages of common labor at this plant. The American Steel & Wire Co., at Fairfield, is running full.

MISCELLANEOUS—The Hinckley Corp. is arranging for the resumption of operations at its sulphite mill at Hinckley, N. Y. The plant has been closed for about 2 years past, and a number of improvements will be made, including repairs to machinery.

The Standard Oil Co. is breaking all production records at its refining plant at Whiting, Ind., refinery, and on an average of 40,000 bbl., or 2,000,000 gal., of crude oil, are being handled daily, or about 3,000 bbl. more a day than during the pre-war period of 1917-18.

New Companies

THE SURFIX CHEMICAL CO., Detroit, Mich., has been incorporated with a capital of $10,000, to manufacture chemicals and chemical byproducts. The incorporators are George W. Stallings, A. F. and W. H. Knobloch, 3217 Clairmount Ave., Detroit. The last noted represents the company.

THE LEONARD PAPER GOODS CO., Boston, Mass., has been incorporated with a capital of $100,000, to manufacture paper products. Elbert O. Leonard is president; and Andrew J. Wright, 500 Park Ave., Worcester, Mass., treasurer.

THE PLASTIC PRODUCTS CO., Detroit, Mich., has been incorporated with a capital of $25,000, to manufacture paints and kindred products. The incorporators are Russell S. Collins, E. F. and Alfred D. Covert, 1940 Highland Ave., Detroit.

THE CYACO CHEMICAL CO., New York, N. Y., care of Jenks & Rogers, 67 Wall St., representatives, has been incorporated with a capital of $20,000, to manufacture chemicals and chemical byproducts. The incorporators are C., I. and A. Juster.

THE DALTON MALLEABLE CASTING CO., Warsaw, Ind., has been incorporated with a capital of $350,000, to manufacture iron and other metal castings. The incorporators are Donald J. and J. S. Dalton, and T. C. and W. D. Frazer, all of Dalton.

THE NATIONAL ART POTTERY CO., Camden, N. J., care of S. Stanger Iszard, 314 Market St., Camden, representative, has been incorporated with a capital of $125,000, to manufacture pottery products. The incorporators are Howard W. Willett, Curtis J. Rothermel and Frederic W. Lineaweaver.

THE MISSOURI GLUE CO., St. Louis, Mo., has been incorporated with a capital of $70,000, to manufacture glue, paste and other adhesive products. The incorporators are Albert Goetz, McCune Gill and T. J. Sheridan, all of St. Louis.

Manufacturers' Catalogs

THE WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., has issued a 20-page booklet, Folder 4506, entitled "Salient Facts on Silent Gears." The booklet describes the advantages of the use of micarta gears and pinions and gives photographs and data describing some of their applications, tables of gear data, etc. This company has also issued Leaflet 1867, which describes electrical equipment for coke plant machinery. Illustrations of the uses of electricity in by-product plants are shown, with recommendations as to the various types to be used.

THE REFRACTORIES MANUFACTURERS ASSN. calls attention to a booklet entitled "Brands Used in the Refractories Industry." It lists the brands used by practically all of the manufacturers of refractory brick and is useful to a man who knows the brand he wants to use, but who doesn't know who makes it. A copy will be sent gratis on receipt of a written request to the association, 840 Oliver Bldg., Pittsburgh, Pa.

THE CHASE METAL WORKS, Waterbury, Conn., has published a very interesting catalog on Chase Condenser Tubes, which describes the technical manufacture and control exercised in making high-grade tubing. It illustrates and describes the manufacture of condenser tubes, the steps in manufacture, the properties and specifications, condenser tube service and a list of those who use the tubes.

THE LINK-BELT CO., Nicetown, Philadelphia, Pa., has published a Portable Loader catalog embracing its entire line of portable equipment. Copies can be obtained by addressing the manufacturers. It contains complete specifications of all of the standard machines, which include the one-man power swiveling loader, the portable belt conveyor, the standard type "A" machine for anthracite coal, and "CS" loader for handling sand and gravel.

CHALMERS & WILLIAMS, Chicago Heights, Ill., have issued a unique pamphlet in the form of a book, entitled "The 100 a Year Club." It describes and illustrates the Symons disk crushers.

EMIL E. LUNGWITZ, New York, is distributing a booklet on Haubold Self-Unloading Centrifuge. This centrifuge is built in two styles, either half automatic or absolutely automatic. This booklet concerns itself with the half-automatic centrifuge solely. The absolutely automatic centrifuge is the subject matter of another booklet which will be sent to those desiring it. The half-automatic centrifuge will handle such materials as calcium carbonate, calcium sulphate, magnesia carbonate, barium sulphate, barium carbonate, alumina, cyanide slimes, flotation concentrates, starch, short fibers, etc., which at present are handled by the various makes of leaf and rotary suction filters. In addition it is claimed that it will filter fine to coarse crystals of any chemical composition.

F. J. RYAN & Co., Philadelphia, Pa., have issued a bulletin on oil burners for all industrial heating operations. It contains information on the way of determining the amount of air necessary for proper combustion and the correct proportions of air with oil.

SPRAGUE SMITH CO., 162 West Randolph St., Chicago, is issuing a booklet on "Glass and Glazing" which is being distributed by the National Glass Distributers Assn. The object of the booklet is to present to the users of glass a standard or guide for the architect, owner or contractor, by which the material may be better known and more readily understood. It briefly describes the more important and different kinds of glass for building purposes, with regard to adaptability for certain definite uses, and gives printed illustrations. The booklet does not cover every department of structural glass or to go exhaustively into the details of the artistic, but is confined to the everyday materials which are often thought so simple as to need no consideration.

THE BEACH-RUSS CO., New York, has issued five new pamphlets. No. 20 is on vacuum pumps for vacuum heating systems; No. 25 is on patented gas and oil-burning rivet-heating furnaces; No. 26 on high-vacuum finishing pumps; No. 30 is on rotary pumps, and No. 29 is on gas boosters.

THE ESTERLINE-ANGUS CO., Indianapolis, Ind., has issued two bulletins, No. 1122, entitled "How to Make a Plant Survey," and Bulletin No. 1222, on "Instruments for Recording Condenser Leakage."

W. A. JONES FOUNDRY & MACHINE CO., Chicago, Ill., announces catalog 26, on speed reduction drives, which is very elaborate. The information should be of value to consulting engineers, superintendents, chief engineers, master mechanics, etc. It embodies technical and practical information, complete descriptive matter and illustrations of typical drives. The installation section presents pictorially reducer drives in many large industrial plants, and dimensions, weights and horsepower ratings for complete speed reduction sets are shown.

THE ROTO CO., Hartford, Conn., in a new 32-page booklet illustrates and describes Roto tube cleaners, air, steam or water driven, for fire tube and water tube boilers, fuel economizers, condensers, evaporators, feed water heaters, locomotive arch tubes, oil stills, etc.

Industrial Notes

THE OILGEAR CO., Milwaukee, Wis., has opened an office in Detroit, at 415 East Jefferson Ave. Donald Clute, who formerly handled the sale of Oilgear products for the Cadillac Machinery Co., has been placed in charge of this office.

THE COLUMBIA STEEL CORP., San Francisco, Calif., has engaged Freyn, Brassert & Co. as consulting engineers for the construction of its new blast-furnace plant at Provo, Utah.

THE STANDARD CONVEYOR CO., North St. Paul, Minn., announces that it has acquired by purchase all the rights, titles and patents pertaining to the "Brown Portable" line of portable and sectional piling, elevating, conveying, loading and unloading machinery for the handling of packed and loose materials. This line of machinery has been manufactured by the Brown Portable Conveying Machinery Co. at North Chicago for 10 years. Until further notice the plant will be continued in operation by the Standard Conveyor Co., to which all inquiries and correspondence should be addressed. The organization which has developed the portable conveying machinery will continue with the Standard Conveyor Co.

THE MINE & SMELTER SUPPLY CO., with branches in Denver, Salt Lake City and El Paso, has taken over the exclusive representation for Colorado, Utah, Nevada, Wyoming, New Mexico and western Texas for Wilson plastic-arc welders and Wilson color-tipt welding metals, for the Wilson Welder & Metals Co., New York City. The Wilson machine and metals were used during the world war in repairing the damage done to a large number of the interned German vessels. Electric arc welding was the method chosen by which the damaged machinery parts of this fleet of vessels were put in operating and seagoing condition and the work was completed within 6 months' time. This machine is also used in railroad shops in the United States and in foreign countries and also by large industrial plants in the United States. The Mine & Smelter Supply Co. will carry in stock at each of its branches a supply of all grades of Wilson color-tipt metals and plastic-arc machines for distribution throughout its territory.

THE CENTRAL STEEL CO., Massilon, O., manufacturer of alloy steel products, has decided to enlarge its field of activities by the addition of special alloy steels for railroad service. This department is under the direction of Irving H. Jones, formerly of Joseph T. Ryerson & Son, Chicago. Mr. Jones will maintain offices in the Peoples Gas Bldg., Chicago, which is the Western headquarters of the Central Steel Co.

The board of directors of the BUFFALO FOUNDRY & MACHINE CO., Buffalo, N. Y., at a recent meeting announced the election of two new officers: C. W. Pearson, who has been associated with the company in various managerial positions for a number of years and for the past year in charge of sales, becomes vice-president and treasurer. In addition to the new duties his promotion will bring, Mr. Pearson will continue as director of sales. P. J. Krentz, who for a number of years past has been works manager, has also been elected as vice-president. As in the past, he will continue actively in charge of manufacture and production. Both Mr. Pearson and Mr. Krentz have been with the company almost from its organization. Their promotions come as no surprise to those familiar with their activities.

THE TH. GOLDSCHMIDT CORP., 15 William St., New York City, has just been founded by the Th. Goldschmidt A. G., in Essen, which years ago also founded the Goldschmidt Detinning Co. and the Goldschmidt Thermit Corp., now united in the Metal & Thermit Corp. The Th. Goldschmidt Corp. represents the Th. Goldschmidt A. G. and its affiliated firms, the Chemische Fabrik Buckau A. G. of Magdeburg, Neufeldt & Kuhnke of Kiel and several other European concerns, for the sale of their products and for the exploitation of new processes and apparatus in the United States and Canada. The president of the corporation is Dr. Franz Meyer, manager of the Th. Goldschmidt A. G., formerly director and officer of the Metallurgical Co. of America, a subsidiary of the American Metal Co., Ltd., and consulting engineer of the General Chemical Co.

Coming Meetings and Events

AMERICAN ASSOCIATION OF CEREAL CHEMISTS will hold its ninth annual convention at Hotel Sherman, Chicago, June 4 to 9.

AMERICAN ASSOCIATION OF ENGINEERS will hold its annual convention in Norfolk, Va., May 7 to 9.

AMERICAN CHEMICAL SOCIETY will hold its spring meeting April 3 to 7, 1923, at New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting May 3, 4 and 5, 1923, at the Commodore Hotel, New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold a meeting in Cleveland, O., April 28 to May 4.

AMERICAN GAS ASSOCIATION will hold its annual convention the week of Oct. 15 at Atlantic City. An elaborate exhibition of gas-making and gas-utilization equipment is planned.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its summer meeting June 20-23 at Wilmington, Del.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its twentieth annual convention at the Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

AMERICAN OIL CHEMISTS' SOCIETY will hold its annual meeting at the Eastman Hotel, Hot Springs, Ark., April 30 and May 1.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its spring meeting May 28 to 31 in Montreal, Canada.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday June 25, 1923, and ending either Friday or Saturday of that week.

ENGINEERING SECTION of the National Safety Council will hold a mid-year safety conference April 17 in the auditorium of the Western Society of Engineers.

IRON AND STEEL INSTITUTE (London) will hold its annual meeting May 10 and 11 at the House of the Institution of Civil Engineers, London, S. W. 1.

NATIONAL ASSOCIATION OF MANUFACTURERS OF THE UNITED STATES OF AMERICA will meet in annual conference May 14 to 16, inclusive, at the Waldorf-Astoria, New York City.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH) will be held in New York Sept. 17-22.

NATIONAL FOREIGN TRADE COUNCIL has postponed its annual conference from April 25, 26 and 27, to May 2, 3 and 4. It will be held in New Orleans, La.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

FIFTH PAN-AMERICAN CONFERENCE will be held at Santiago, Chile, March 25, 1923.

SOCIETY FOR STEEL TREATING — Eastern sectional meeting will be held June 14 and 15, in Bethlehem, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS, with headquarters in Chicago, will hold its spring convention in Cincinnati, April 18, 19 and 20, 1923. The major subject will be "Management Problems of the Smaller Plants."

A PAPER INDUSTRIES EXPOSITION will be held in Grand Central Palace, New York City, during the week of April 9, 1923, by the International Exposition Co.

The following meetings are scheduled to be held in Rumford Hall, Chemists' Club, East 41st St., New York City: March 23—Society of Chemical Industry, regular meeting. April 20 — Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting. May 4—American Chemical Society, regular meeting. May 11—Société de Chimie Industrielle (in charge), American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting. May 18—Society of Chemical Industry, regular meeting. June 8 — American Chemical Society, regular meeting.